MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 38 JANUARY, 1932 Number 5

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 400-D

DEPARTMENTS

Total Distribution for December, 16,152 Copies

PUBLISHED MONTHLY BY

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE STREET, NEW YORK

ROBERT B. LUCHARS, President EDGAR A. BECKER, Vice-pres. and Treasurer ERIK OBERG, Editor FRANKLIN D. JONES, Associate Editor
CHARLES O. HERB, FREEMAN C. DUSTON and JOSEPH E. FENNO, Assistant Editors
LONDON: 52-54 High Holborn PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.

Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

MACHINERY

Volume 38 NEW YORK, JANUARY, 1932 Number 5

An Industry That Hibernates

A New England Manufacturer Contemplates the Hibernating Bear, and Gives Some Timely Advice to Machinery Builders Who are Laying Plans for a Return to Normal Conditions

By RALPH E. FLANDERS
Manager, Jones & Lamson Machine Co., Springfield, Vt.

UP in our northern woods the bears still roam the mountains. Contrary to common opinion, they are cautious, even timid animals. If one comes upon them by surprise, they crash through the underbrush with a noise like that of a junk dealer's loaded truck going through a covered bridge. About the only time the ordinary citizen comes upon them, or their remains, is in the form of a bit of palatable steak at a Fish and Game Club banquet.

Yet the bears do not do so badly. During the summer and fall they get their fill of berries, acorns, succulent roots, wild honey, and the like, and for an occasional celebration they will descend upon the sheep pasture. When winter comes, they have accumulated a thick layer of fat under their skins. This fat is the bear equivalent of money in the bank, and on this undivided surplus they subsist through the long winter months; for the bear is a hibernating animal.

It is not so with the bobcat and the deer. These animals find their nourishment available at all seasons of the year. There is for them no enforced suspension of normal functions, merely a tightening of the conditions under which they must be exercised.

There are Industries with Habits Like Those of the Hibernating Bear

This leads us to the thought that there are bear industries and bobcat industries. The bear industries are like the machinery and especially the machine tool field. There are times when their products are in demand, and there are times when there is no demand at all. Then, again, there are bobcat industries whose products are in some demand at any time and under any circumstances. The makers of soap, of staple foods, or of surgical supplies do not suffer the collapse of demand to which some other businesses must adapt themselves. They can more easily adjust their policies to the rigors of depressions. It is such businesses that are in a position to maintain permanent employment programs and other enlightened policies that help to even out those economic extremes that bring distress to all alike.

But the machinery and equipment industry, and especially the machine tool branch, which is an equipment industry to equipment industries, is far removed from the sustained flow of consumer necessities. Such industries must expect, as a normal procedure, to be doomed to go through greater extremes of activity than any other line of business. In 1921 the ratio of sales of the preceding boom year to those of the depression year was as 12 to 1 in the machine tool industry—a severity of fluctuation not approached by any other business reported in the Government census. At the present time the drop has not been so severe, thanks to the Russian orders of a year or so ago; but the Soviets are no longer effectively in the market.

This is a Good Time for Constructive Thinking

Does a bear think while in winter quarters? I don't know about those out in the mountains; but I am sure that those engaged in "bear" industries ought to do so.

So long as the postman stops at his door, the manufacturer has an opportunity to keep in touch with the newest and best ideas throughout the engineering world. He may profitably read and ponder some of the papers presented at the recent meeting of the Mechanical Engineers—for instance, the one read by E. G. Field before the Management Division with the forbidding title, "Dividend Programs Related to Depreciation." In this he may learn how some industries run their fat off in the good prosperous summertime, and have no reserves left for the winter.

This is just what the business does that sets up its reserves for depreciation as a bookkeeping account only, and does not retain them as an actual available liquid fund for physical replacement when wear and obsolescence have done their predestined work. Many millions of such reserves —released by faulty bookkeeping and unwise financial policy—have been paid out in unwarranted dividends.

This has had two results: The business itself deteriorates in its physical equipment to the point where competition compels re-equipment; and when that point is reached, there are no funds available for the process. A second effect springs from the unwarranted dividends originally declared. These spread abroad a falsely exaggerated view of available profits. Observing investors seek the field, and new well-equipped competition falls upon the old business just as it realizes that it must re-equip and is in no condition to do so. Such has been, in fact, the history of the cotton textile industry.

The equipment builder may well examine his own practice in this matter and also may well sigh for customers whose policies have been above reproach in this direction.

Business today would be more active if it had not been the practice in some industries to leave no reserves for the winter of depression. Many a business sets up its depreciation reserve as a bookkeeping account only, and does not keep an actual liquid fund for physical replacement of equipment when wear and obsolescence demand new and better machinery. Millions of such reserves have been paid out in unwarranted dividends because of faulty bookkeeping and unwise financial policy. Every manufacturer will do well to examine his practice in this matter, and mend it if needed.

The Economic Life of Manufacturing Equipment is Another Good Subject for Thought

Another paper for winter reading presented at the Mechanical Engineers' meeting is that by H. O. Vorlander and F. E. Raymond on the "Economic Life of Equipment." Here, for the first time, have been set forth the basic engineering principles of equipment replacement. The details are not yet stated in practical form, and it is left to the practical man to complete the analysis; but the direction is pointed out.

There are, of course, many aspects to the problem of equipment purchases. Is the business itself stable? Will the product made have a continued demand? What about the character, ability, and physical health of the individuals composing the responsible management? What are the general business prospects? After these questions have been asked, and assuming that favorable answers have been given, the analysis can be confidently used as a guide for the expenditure of money on new equipment; and if this procedure had been intelligently followed, not only would much business in the past not have fallen by the wayside, but there would be a steady and life-saving volume of reconstruction and re-equipment business being placed at this very moment.

If, as some social observers are coming to believe, the time is at hand when obvious opportunities for large financial returns will become fewer and fewer, the groundwork done by Messrs. Vorlander and Raymond may turn out to be an even greater service to the investor than to the equipment builder. Financial leaders with foresight will organize to search out the worthwhile opportunities, using such tools as this analysis provides, and will devise forms of credit best adapted to gain the desired ends.

Many manufacturers, however, will heave a melancholy sigh when they think of how far removed are our financial purveyors from policies so constructive as these. They will ruefully remember that the sole and only shred of confidence and enterprise which the financial leaders have exhibited of late has been shown in their eagerness to lend funds to foreign industrial nations to be used to finance large Russian orders—the while sternly and piously refusing similar assistance to their own countrymen.

Returning again to the habits of the bear, every bear family plans to emerge in the spring with one or two healthy cubs. In our industrial metaphor, these represent the progress that is made in design and construction during times of depression. Some will not survive, but others will prove well adapted to their industrial environment. They will fare the better for having proved their worth in a lean time and will soon find themselves firmly established.

If only we knew what direction the age of machines will take, we might develop and train our

new cub machines much more surely. What will be the outstanding development during the coming decade? If it is to be the airplane (which now seems dubious), we would know in a general way what sizes and types of machines to develop. If large-scale railroad electrification is on the slate, we would concentrate on heavier machinery. If the general standard of living for the whole population is to be raised (and physically this is easily accomplished), there will be an immense demand for electrified household machinery; this will require light, quick-acting, automatic equipment for quantity production. If, as some believe, the coming development is to be a great expansion of public works for public use and enjoyment, then a general line of more or less standard tools in reasonably large sizes would be required to produce the needed construction machinery. Who can say?

What does seem sure is that the new developments must be designed with the new cutting materials in view. Tungsten carbide has already arrived for cutting almost any material except ordinary steel; and that it will much longer be baffled by this problem is scarcely to be believed. The new machines, therefore, while more rigid than their predecessors, will differ from them as well in being adapted to continuous employment at high speeds, and will have correspondingly adequate chip room. In addition, the speed and feed controls and other manipulating levers will be carefully worked out to give ease of operation; for with a decrease in cutting time, these other factors will have an increasingly important effect on the day's production.

Watch for the new cubs in the machine tool industry as they come out into the spring sunshine.

What will be the outstanding development during the coming decade? We do not know whether it will be airplane manufacture, large-scale railroad electrification, electrified household machinery, or a great expansion of the public works program. Different types of machines will be required according to which of these developments will predominate. It is certain, however, that new metal-cutting equipment should be designed with the new cutting materials in view. The new carbide tools are with us to stay, and the problems still confronting the makers of these tools will doubtless be solved before long. Hence, rigidity, high speed, and excellent wearing qualities will be prime requisites.

An Industrial Platform for 1932

Abstract of a Report of a Committee of the National Conference of Business Paper Editors, Setting Forth Industrial Objectives for the Coming Year

AMERICAN business and industry has long been characterized by freedom of individual action. If we are to preserve this private initiative within reasonable bounds and with full regard for the public interest, we must accept, as a corollary to our individualism, the principle of cooperative action.

There should be more equitable distribution of employment. This can be effected by (a) shorter working hours per individual per day; (b) a shorter working week; and (c) rotation of employment to provide work for a maximum number. This practice should be extended into those industries that have not yet taken it up and should include public utilities, railroads, and all departments of the federal, state, county, municipal, and township governments.

We feel that employment is the only real solution for unemployment. Emphasis should be placed upon the fact that unemployment relief charities provide only temporary relief and merely postpone the real issue. Recognition of this principle is further argument for early widespread adoption of more equitable distribution of employment as recommended in the foregoing.

It is a universal responsibility to see that abuses do not grow out of wage reduction policies.

In certain industries, such as the building industry, labor leaders should consider the possibilities of moderate voluntary wage reductions, which would serve to increase not only the volume of business activity, but also the volume of employment.

Great stress should be laid upon the principle that national prosperity and the standard of living depend upon the average per capita production, and not on the rate of pay as measured in dollars.

We recommend that economically sound unemployment insurance plans should be undertaken

through the voluntary cooperation of employers and employes. These plans should exclude rigidly governmental contributions, doles, and charities on the grounds that governmental unemployment payments, whether federal, state, or local, are not a true cure for unemployment.

The Use of Machinery Does not Cause Unemployment, but Raises the Standard of Living

Obsolete machinery and methods should be eliminated. There should be widespread recognition of the fundamental fact that mechanization of industry has been greatly responsible for increasing the volume of employment, rate of pay, average standard of living, and national prosperity. It can easily be shown that countries with full employment, but without mechanization, enjoy neither a high degree of national prosperity nor a high average standard of living.

It must be admitted that progress in the mechanization of industry has caused production in certain fields to outrun consumption capacities in the same fields, and thus brought about temporary unemployment. This merely emphasizes the continuous responsibility of business and banking to redirect, along profitable lines, the workers released by the progress in mechanization.

New Useful Products and Better Sales Management will Aid in Business Recovery

Good management carries the responsibility for creating, by intelligent research, new wants for human beings and new uses for utilizing man power. The profits of business in the future will depend largely upon how successful industries are in developing new products and finding new and wider uses for old products.

All business enterprises should devote more attention to the problems of sales management. The chief executives of every company should treat marketing as one of the most important elements in company management as a whole. Our hope of increasing the volume of employment and rate of pay, and of successfully shifting from producing too much of certain things to producing more of those things that will satisfy demands not yet satisfied, lies in aggressive market research.

Business men and bankers should be constantly reminded that the success of any business should always be premised and maintained on the principle that "the degree of success of all business enterprises must depend in the long run upon the value and importance of the service to the consuming public."

Study should be given to the revision of the Sherman and other anti-trust laws with a view to prohibiting the extension of monopolies, but at the same time, permitting the extension of cooperation along those lines that are likely to be in the public interest.

Trade associations should enlarge their activities to a point where they can function as planning boards for their respective industries. In America we believe in individualism, but to insure this status we must spur cooperative action, particularly in broad industrial planning and the thorough research on which such planning must be premised.

Unemployment Could be Largely Averted by Intelligent Planning of Public Work

There should be intelligent long-time planning of public construction, in order to insure maximum employment on work of this kind during periods of depression and minimum employment on such work during booms and periods of excessive inflation. Serious consideration should be given to the possibilities of creating certain new types of public construction on which a minimum instead of a maximum wage scale will prevail, thereby automatically insuring decreases in volume of such construction during periods when private business is able to bid high for human services, and a maximum of employment when the ranks of the unemployed are numerically large.

The Responsibility of the Trade and Business Journals

The business press should organize itself so as to provide American business with unbiased economic facts and recommendations that will prove helpful to individual industries and enterprises in arriving at successful plans for their own business.

Throughout the world, economic understanding and vision is superseding political, financial, and industrial leadership as such. Business papers should rise to the opportunity that is rightfully theirs by assuming a role of major importance in contributing to the kind of thinking that will result in economic leadership of the highest order for the American people.

* * *

Winner of American Machinery and Tools Institute Contest

The American Machinery and Tools Institute has announced the winner of the Drill Jig Design Contest, held under the auspices of the Institute, which ended November 30, 1931. The winner was Wilhelm Larsen, 945 Galt Ave., Chicago, Ill. Certificates of merit were awarded to L. Oeckl, 4673 Scotten Ave., Detroit, Mich., and G. A. Bartel, 460 Twenty-second St., Oakland, Calif. Designs were submitted from every part of the country, and the drawings showed much originality and independence in thought in solving the problem.

* * *

The electric refrigeration industry has opened a new field for Stellite in the form of needle valves. Resistance to both corrosion and erosion is required. Tests have demonstrated that Stellite is the most suitable material available for this purpose. Two of the largest manufacturers of electric refrigerators are now using Stellite as regular equipment for this purpose.

Surface-Grinding Parts with Projecting Hubs

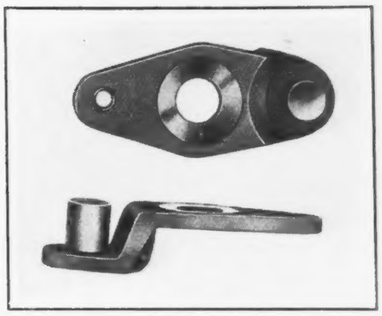


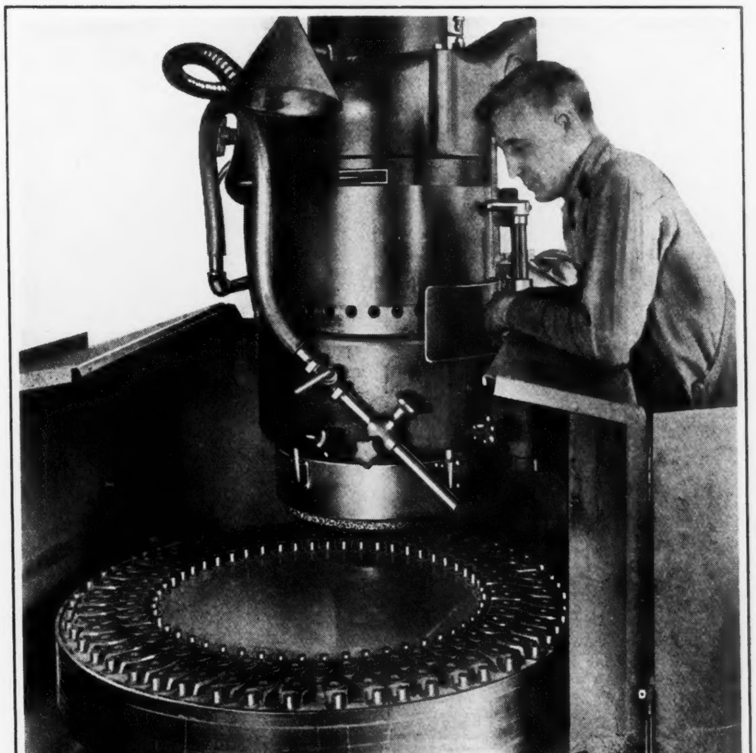
Fig. 1. Four Hundred of These Castings are Ground per Hour

By applying properly designed fixtures to the magnetic chucks on vertical surface grinding machines, the Blanchard Machine Co., Cambridge, Mass., has made it possible to perform accurate grinding operations on parts that would otherwise be difficult to finish by surface-grinding. The work-holding difficulties presented by projecting heads, bosses, etc., that prevent the use of ordinary holding means are overcome by the various fixtures described and illustrated in this article.

Overhanging Ledge Supported by a Ring

In Fig. 1 is shown a gray iron casting ground from the rough on two sides at the rate of 400 pieces, or 800 surfaces, per hour on the machine shown in Fig. 2. The limits on this part are $\pm$ 0.0015 inch. About 0.040 inch of stock is removed from each surface. These parts were formerly disk-ground with a tolerance of 0.006 inch at the rate of 140 per hour. By the use of the method illustrated, the cost of production has been reduced and the accuracy increased.

Fig. 2. Magnetic Chuck of Vertical Surface Grinder Loaded with Parts Like the One Shown in Fig. 1



As shown in Fig. 2, the parts are closely grouped and are supported under the overhanging end by a ring placed directly on the face of the magnetic chuck. By being placed close together, the pieces effectively block each other and prevent side movement. After grinding the surfaces as shown in the illustration, the pieces are reversed and placed directly on the magnetic chuck for grinding the opposite side.

Fixture with Locating Vees

In Fig. 3 is shown a simple fixture employed to supplement the magnetic chuck of the automatic surface grinder used for grinding the wings of shock absorbers. In loading this fixture, the pieces are placed in the vees formed by the radial steel strips, where they are held magnetically. The grinding wheel forces the pieces further into the vees, and thus any tendency to tip is eliminated.

The face of the chuck is cleaned in the usual manner, the cleaner blades extending under the radial steel pieces. Thus the work always rests on a clean surface. This feature is necessary in this case, as the work is held within limits of $\pm$ 0.0005 inch. The pieces are steel forgings and require the removal of about 0.008 inch of stock per side. Nine hundred pieces are ground on both sides per hour.

Concentric Rings for Holding Wing-Shafts on Magnetic Chuck

Wing-shafts for shock absorbers are held on a magnetic chuck equipped with two concentric steel rings, as shown in Fig. 5, while grinding the surfaces of the wings. The two concentric steel rings form magnetic poles, which hold the work securely in place. No special locating pins or pockets are used in this case. The regular cleaner is employed for cleaning the fixture. Slots milled in the two rings allow the grinding solution

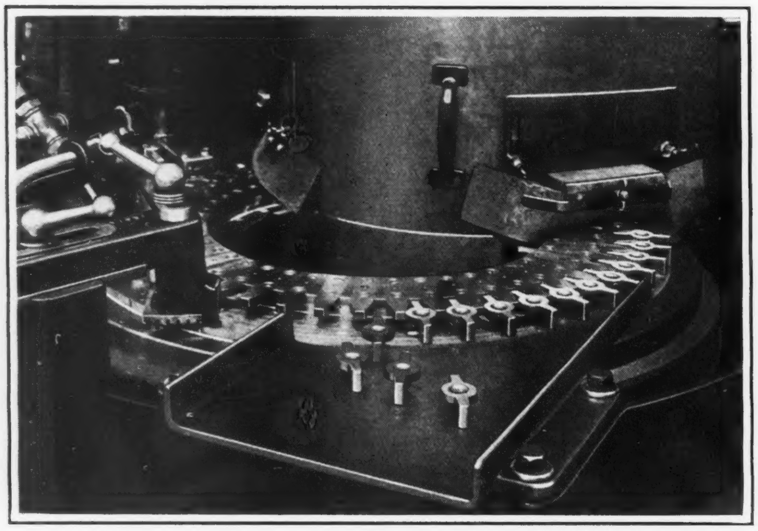


Fig. 3. A Simple Fixture Applied to the Magnetic Chuck Serves to Keep the Pieces Properly Positioned

to drain back into the base and also serve to localize the magnetizing power. These steel forgings are ground at the rate of 900 pieces per hour and are held within limits of ± 0.0005 inch. About 0.008 inch of stock is removed in grinding.

Fixture for Grinding Airplane Propeller Hub

In order to get a flat, accurate joint surface for the halves of forged-steel propeller hubs, such as shown in Fig. 4, the parts are located in a fixture in the center of a Blanchard chuck, as shown in Fig. 6. The entire surface of the joint is ground first, after which the chuck is run out part way and the wheel fed down to remove about 1/16 inch of stock on the clearance surfaces. This allows the two halves of the hub to be clamped together, metal to metal, and the shank of the propeller blades to be clamped in the hub by the clamping straps, which are also ground on the Blanchard machine.

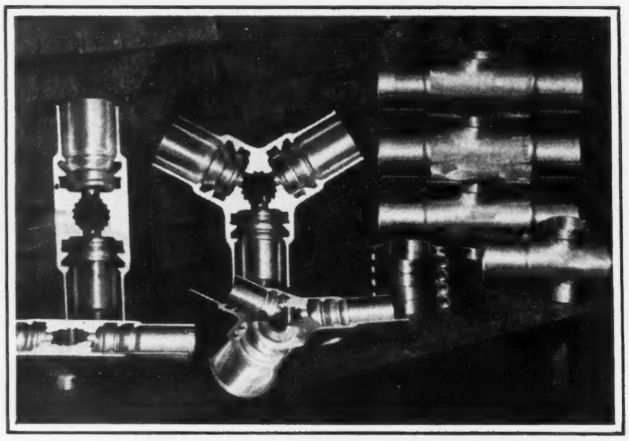


Fig. 4. Airplane Propeller Hubs Ground with Stepped Surfaces to Give Clamping Clearance

Fixture for Holding Differential Side Gears

In Fig. 7 is shown a fixture used on a 30-inch magnetic chuck for grinding thirty automobile differential side gears at one time. These bevel gears have a hub that projects into a hole in the magnetic plate or fixture. The front face of the gears is ground parallel to the back face and within limits of 0.003 inch for thickness. The back of the hub is then ground, with the previously ground face located directly on the magnetic chuck. The two sides must be parallel within close limits. These gears are made from S A E 2315 steel and are 3 inches in diameter. The production rate is 110 pieces, or 220 surfaces, per hour.

Automobiles in 1932

There is now a considerable shortage of new passenger cars. For nearly two years this shortage has been growing and creating a market for the new models. Naturally, buyers are awaiting the automobile shows to inspect these cars before purchasing.

We look for an increase in automobile manufacture in the next six months similar to that which occurred from November, 1930, to June, 1931. It has been repeatedly claimed that the back of any depression can be broken by putting on the market a new and better "something" that everybody needs or wants and at a lower price. This is just what the automobile manufacturers are planning to do for 1932 and to begin producing them at once.

This will bring increased business, not only to automobile producers, but also to steel mills, tire, glass, and other factories, and accessory manufacturers. Here is news to strengthen confidence. —From *Looking Ahead,* by Alvan T. Simonds and John G. Thompson

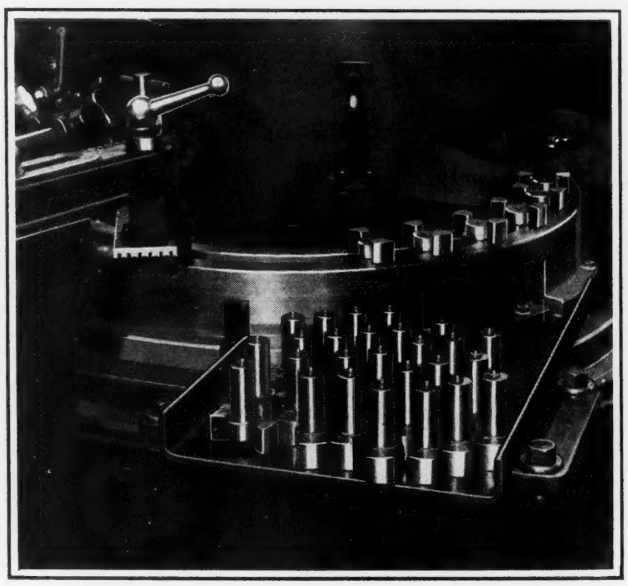


Fig. 5. Two Concentric Steel Rings Form the Magnetic Poles for Holding the Work Shown

Photo-Electric Eye Operates Spray Guns

Priming coats of paint can now be applied to lumber with the help of the photo-electric eye, thus protecting the lumber from change in moisture content, infection by fungus growth, etc. The DeVilbiss Co., Toledo, Ohio, with the assistance of the General Electric Co., has designed a spray priming equipment, using aluminum paint for this purpose. The new equipment operates at a speed of from 60 to 200 lineal feet or more per minute, depending on the speed of the conveyors feeding lumber to and taking it from the priming machine. The operation is entirely automatic.

The priming equipment is in the form of a spray painting booth with apertures through which the lumber enters and leaves. Two sets of spray guns operate inside the booth. As the lumber enters the booth it trips a small "flag" which intercepts a beam of light falling on one of two photo-electric tubes. The impulse set up in the tube causes the first set of spray guns to operate, coating the face, one edge, and one end of the board as it passes through the booth. When the board reaches the exit side of the booth, it actuates a second photo-electric relay in the same manner, causing a second set of spray guns to spray the back edge, other side, and other end of the board as it leaves the booth. Thus a uniform priming coat is applied to all surfaces of the lumber at one operation. As the lumber leaves the booth, the "flags" are released, allowing the light beams to shine on the photo-electric tubes once more, and stopping the spray until the next board arrives. According to the DeVilbiss Co., the cost of such over-all priming ranges from $8 to $10 per thousand board feet. While aluminum paint is now used, other materials, such as paint and oil, can be used readily with the equipment.

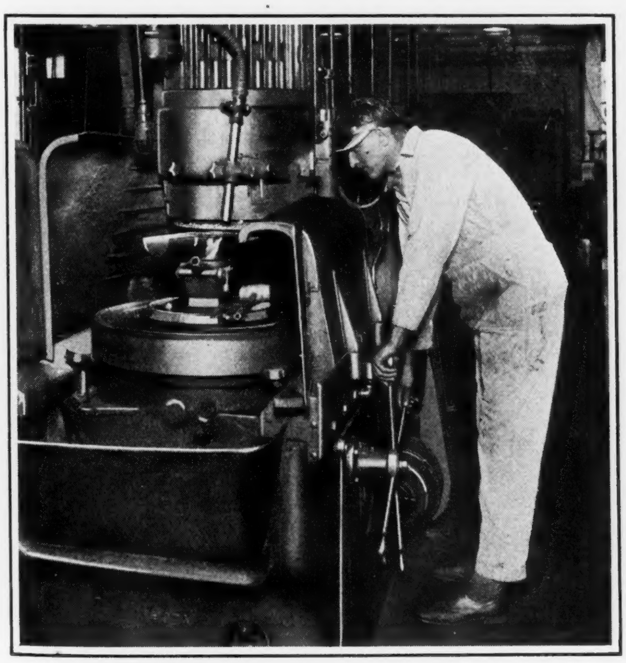


Fig. 6. Grinding the Joint and Clearance Surfaces on Propeller Hubs Such as Illustrated in Fig. 4

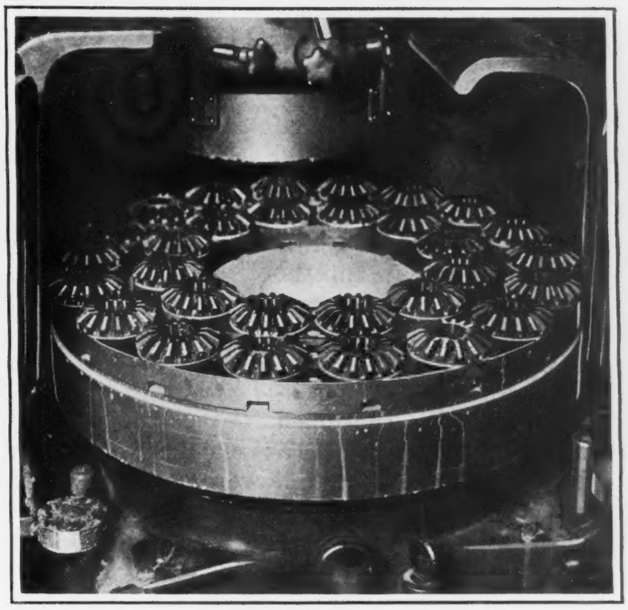


Fig. 7. Magnetic Chuck Equipped for Holding Thirty Bevel Gears Having Projecting Hubs

Hardening Metals by Rotating Magnetic Fields

In May, 1931, MACHINERY, page 670, a brief article was published relating to a discovery by Edward G. Herbert, Manchester, England, of a method for hardening metals by rotating magnetic fields. Further experiments have now been conducted with this method, which is expected to have important practical applications. The process has been patented.

It has been found possible to induce and render permanent a very high degree of hardness in such articles as razor blades, drills, and other tools. The specimen to be treated is placed across the gap of a powerful magnetic field, and is rotated once so as to change the direction of polarization through 360 degrees.

High-speed steels are usually treated hot. The most favorable temperature depends upon the characteristics of the steel, but is generally not above 480 degrees F. As the rotary treatment requires only a few seconds, the article can be preheated in a bath and transferred to the magnet while hot. Complete details covering the new process are given in a recent number of *Metallurgia,* in an article "Hardening Metals by Rotating Magnetic Fields," by E. G. Herbert, 149 Barlow Moor Road, West Didsbury, Manchester, England.

* * *

Helium gas, the filling medium used for the airship *Akron,* is found only in certain sections of the natural gas fields in southwestern Texas in sufficient quantities for commercial use. At the present rate of consumption, the available supply will last over 100 years.

Planetary Gearing with Two Driving Members

Methods of Determining Speed of Driven Member with Two Driving Members Rotating at Different Speeds

By FRANKLIN DeRONDE FURMAN
Professor of Mechanism and Machine Design
Stevens Institute of Technology

THE usual forms of planetary gear wheel mechanisms have one fixed gear wheel that serves as a fulcrum to insure definite relative motions in all the moving parts. Such planetary mechanisms are, in principle and effect, merely straight bar leverage mechanisms adapted to continued rotary motion in which there is one drive shaft, one fixed "shaft," and one follower shaft, all with toothed gear wheels or with suitable arms or disks attached.

The special case of the planetary gear wheel mechanism treated in this article goes one step further in that it considers the fulcrum, or the so-called "fixed" gear wheel itself to be moving because of an independently applied motion. This is in addition to the motion applied to the regular drive wheel in the usual planetary gear mechanism.

Problems in planetary gear mechanisms are generally so elusive in their nature, doubtless because they are literally "wheels within wheels," that one cannot always be certain that a quick result obtained by the use of a formula is correct. It is always desirable to apply a check by some independent method, such as a graphical method. Although the graphical method cannot be exact in itself, it furnishes all the lines and proportions needed for a series of right triangles whose sides can be readily computed to give the exact answer. This is illustrated in Fig. 1. Because this graphical method is simpler and more certain than the analytical or mathematical method, it will be used first in the solution of the following problem.

Given a planetary gear mechanism in which the train-arm *AB*, Fig. 1, is the initial driver, making 70 revolutions per minute, and the sun wheel D_2 is the auxiliary driver, making 210 revolutions per minute, both clockwise: Find the direction of turning and the number of revolutions per minute of the follower wheel D_1. The sun wheel D_2 has 24 teeth, the planet wheel D_3 has 18 teeth, and the internal follower wheel D_1 has 60 teeth.

The solution of this problem by the graphical method is given in Fig. 1. Let the line *BM*, to any desired scale, represent the tangential linear velocity of point *B* of the train-arm, which is making 70 revolutions per minute according to the data. As will be seen presently, it is not necessary to compute the actual tangential velocity. In other words, *BM* may be taken any length to represent the tangential linear velocity at *B*. By drawing a straight line from *M* to *A*, *CO* is obtained as the corresponding linear velocity of point *C* on the train-arm. If *CA* is now adopted as a unit radius to be observed and adhered to throughout the solution of the problem, *CO* may also be regarded as the angular velocity of the train-arm; in other words, *CO* actually represents 70 revolutions per minute of the train-arm.

Since the sun wheel D_2 is to make 210 revolutions per minute, it has three times the angular velocity of the train-arm *AB* and, therefore, *CP*, equal to three times *CO*, and at the adopted unit radius, represents the assigned velocity of wheel D_2. Since *CP* and *BM* also represent linear velocities, according to some suitable scale which need not be determined, and since these two linear velocities are impressed on the planet wheel D_3, the instantaneous center of wheel D_3 will be at *Q*, and, finally, the

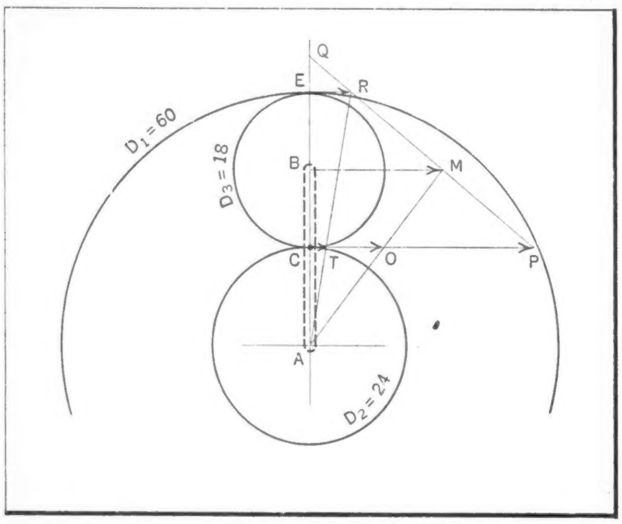


Fig. 1. Graphical Solution of the Planetary Gearing Problem

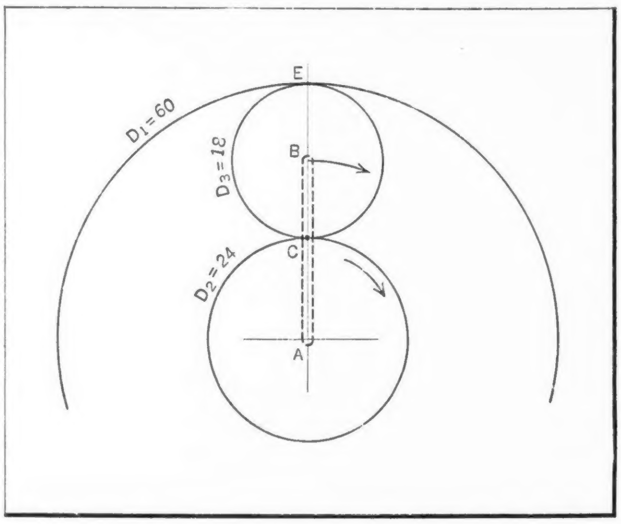


Fig. 2. Diagram Used in Solving Problem by Analytical Method

point E on wheel D_3 will have a linear velocity ER. This will also be the linear velocity of point E of the internal follower wheel D_1. Since ER is the linear velocity of point E on the follower wheel, at the same scale as the linear velocities CO and CP, then the angular velocity of the follower wheel, measured at the unit radius AC, is CT.

Since CO represents the angular velocity of the driving train-arm AB, and since CT represents the angular velocity of the follower wheel D_1,

$$N = \frac{CO}{CT}$$

in which N = number of turns of the driver train-arm to one of the follower wheel.

Measuring CO and CT to any suitable scale, $CO = 5$ and $CT = 1$. Then

$$N = 5$$

Thus the follower wheel D_1 makes 14 revolutions per minute while the train-arm makes 70 revolutions per minute.

Since such small measurements as CO and CT cannot always be made accurately enough to give exact results, it is safer to write the word "approximate" after the expression, as follows, when the graphical method is used:

$$N = \frac{CO}{CT} = \frac{5}{1} \text{ approximately}$$

Solution by Geometrical Method

By making use of the geometry of the right triangles in Fig. 1, a computation may be made, based on the graphical method construction, to give the exact answer, as follows:

It is desired to compute the ratio,

$$N = \frac{CO}{CT}$$

In order that no measurements be taken on the drawing, let $CO = 1$ and $CP = 3$, according to the ratio 70 and 210 revolutions per minute, as given in the data for the problem. Also, in the following work, the vertical sides of all triangles that are used are in terms of the radii or the diameters of the wheels, and they occur in pairs so arranged that the numbers of teeth on the wheels, as given in the data, may be used to express the desired ratios, again avoiding the necessity of taking any measurements on the drawing, or even on a rough unscaled sketch.

From the sketch,

$$\frac{BM}{CO} = \frac{BA}{CA} \text{ or } BM = \frac{1 \times 21}{12} = \frac{7}{4}$$

Also,

$$\frac{BQ}{CQ} = \frac{BM}{CP}$$

Substituting the values $BQ = 9 + X$ and $CQ = 18 + X$, we have:

$$9 + X = \frac{(18 + X) \times 7/4}{3} \text{ or } X = \frac{18}{5} = EQ$$

Then

$$BQ = 9 + \frac{18}{5} = 12\frac{3}{5}$$

Also

$$\frac{ER}{BM} = \frac{EQ}{BQ} \text{ or } ER = \frac{\frac{7}{4} \times \frac{18}{5}}{\frac{63}{5}} = \frac{1}{2}$$

and

$$\frac{CT}{ER} = \frac{AC}{AE} \text{ or } CT = \frac{\frac{1}{2} \times 12}{30} = \frac{1}{5}$$

Finally,

$$N = \frac{CO}{CT} = \frac{1}{1/5} = 5$$

Application of Analytical Method

A quick and direct solution of this problem by the analytical or mathematical method, without the use of any velocity lines, is as follows:

$$N_1 = 1 - 2 \times \frac{D_2}{D_3} \times \frac{D_3}{D_1}$$
$$= 1 - 2 \times \frac{24}{18} \times \frac{18}{60}$$
$$= 1 - 2 \times \frac{2}{5} = \frac{1}{5}$$

where N_1 = number of turns of the follower wheel D_1 to one of the driver train-arm.

$$N = \frac{1}{N_1} = 5$$

in which N = number of turns of driven arm to one turn of follower.

The formula just used for N_1 may be deduced in a purely analytical manner, starting with the proportions used in the geometrical method, but it is an additional and even more laborious process than the geometrical method itself. The same formula can be set down directly by an inspection of a diagram such as Fig. 2, even though the diagram is not drawn to scale. The line of reasoning that permits the writing of this formula by mere inspection is as follows:

An imaginative time unit is adopted, based on the time required for the train-arm to turn through 360 degrees.

All wheels and the train-arm are first considered as being locked together and given one full turn clockwise, thus turning the follower wheel D_1 one revolution and the driver train-arm one revolution. Assuming that clockwise motion is in a plus direction, then

$$N_1 = +1$$

According to the data given in this problem, the wheel D_2 makes three turns while the train-arm turns once. It is therefore necessary to give D_2 two more turns while the train-arm is at rest, at the end of its first turn. With D_2 then turned clockwise, D_3 will make $\frac{D_2}{D_3}$ turns counter-clockwise for

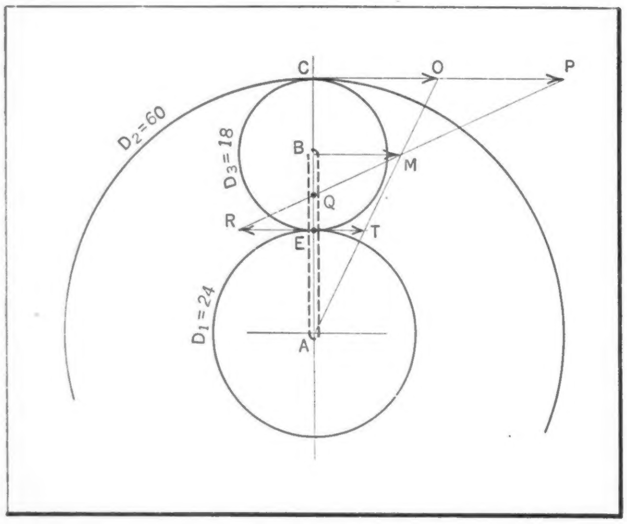


Fig. 3. Another Planetary Gearing Problem with a Graphical Solution

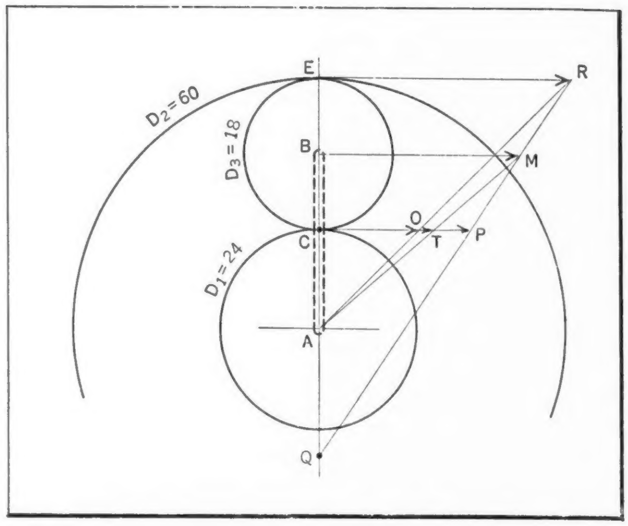


Fig. 4. Problem where D_1 and D_2 are Drivers and Train-arm AB the Follower

each turn of D_2, and D_1 will be turned counter-clockwise $\frac{D_2}{D_3} \times \frac{D_3}{D_1}$ times. Calling clockwise rotation plus and counter-clockwise rotation minus, we now have the complete formula,

$$N_1 = +1 - 2 \times \frac{D_2}{D_3} \times \frac{D_3}{D_1}$$

If the diameters of the wheels are represented by their numbers of teeth,

$$N_1 = +1 - 2 \times \frac{24}{18} \times \frac{18}{60} = +1 - \frac{4}{5}$$

or

$$N_1 = \frac{1}{5} \text{ and } N = 5$$

This means that the train-arm driver AB in Fig. 2 will make five turns to one turn of the follower wheel D_1, both turning in the same direction, when the sun wheel D_2 is given three times the angular velocity of the train-arm AB in the same direction.

When Speeds of Sun Wheel and Train-Arm are Such that Follower is Stationary

If the sun wheel D_2 had three and one-half times the angular velocity of the train-arm, instead of three times, the follower wheel D_1 would not move, but would stand stationary while the two driving members continued to turn. This is shown by the analytical method as follows,

$$N_1 = 1 - 2\frac{1}{2} \times \frac{24}{18} \times \frac{18}{60} = 0$$

or

$$N = \frac{1}{N_1} = \frac{1}{0} = \text{infinity}$$

This means that it would require an infinite number of turns of the train-arm driver to produce one turn of the follower wheel D_1; in other words, the wheel D_1 would stand still. This is also directly indicated by $N_1 = 0$, which means zero turns of the follower wheel D_1 for one turn of the train-arm AB.

When Difference in Speed of Drivers Causes Reverse Rotation of Follower

If the sun wheel D_2 were being driven with four times the angular velocity of the train-arm AB, both rotating clockwise, the follower wheel D_1 would turn backward, or counter-clockwise, as shown by the following equation:

$$N_1 = 1 - 3 \times \frac{24}{18} \times \frac{18}{60} = -\frac{1}{5} \text{ or } N = -5$$

This means that for each five turns of the train-arm AB clockwise, the follower wheel D_1 will turn once in a counter-clockwise direction.

Both the special cases just given can be readily shown by the graphical method illustrated in Fig. 1, as follows:

First, make $CP = 3\frac{1}{2} \times CO$, when the new line PM extended will pass through E. The new ER will be zero, and consequently CT will be zero, and

$$N = \frac{CO}{\text{new } CT} = \frac{1}{0} = \text{infinity}$$

Second, make $CP = 4 \times CO$. Then the new line PM will pass to the left of E, the new ER will be in the opposite or counter-clockwise direction, and so will the new CT. Then,

$$N = \frac{+CO}{-CT} = \text{a value to be measured from the completed diagram.}$$

Finding Speed of Sun Wheel when Train-Arm and Internal Wheel are the Drivers

Another problem is shown in Fig. 3, in which the train-arm AB is given 70 revolutions per minute and the internal wheel D_2 is given 140 revolutions per minute. Find the revolutions per minute of sun wheel D_1. This problem will be solved by applying the graphical and analytical methods previously explained. The given angular velocity of the train-arm is BM, and $CP = 2CO$, which is the doubled

angular velocity assigned to the internal wheel D_2. ET and ER are the velocities of point E considered as on the train-arm and on the follower wheel D_1, respectively. Then,

$$N = \frac{+ET}{-ER}$$

which, measured to scale, gives

$$N = \frac{+2}{-3} = -\frac{2}{3}, \text{ approximately}$$

This means that two turns of the driver train-arm in a clockwise direction produces three turns of the follower sun wheel D_1 in a counter-clockwise direction. Inasmuch as the train-arm turns 70 revolutions per minute in this problem, the sun wheel follower D_1 turns $70 \times \frac{3}{2} = 105$ revolutions per minute in the opposite direction.

By the analytical method,

$$N_1 = 1 - 1 \times \frac{D_2}{D_3} \times \frac{D_3}{D_1} = 1 - \frac{60}{18} \times \frac{18}{24} = -\frac{3}{2}$$

or

$$N = -\frac{2}{3}$$

Finding Speed of Train-Arm when the Internal Wheel and the Sun Wheel are the Drivers

The planetary mechanism in Fig. 4 calls for one more step in the analytical solution when the train-arm AB is the follower and the internal wheel D_2 and the sun wheel D_1 are the drivers.

The data for the problem are: Sun wheel D_1 drives clockwise 96 revolutions per minute, and the internal wheel also drives at a speed of $\frac{2}{3}$ of D_1 in the same direction. What will be the revolutions per minute and the direction of turning of the train-arm AB?

In the graphical solution $CP = 96$ revolutions per minute, $CO = \frac{2}{3}CP$, and ER is the linear velocity of point E on wheel D_2. BM is the linear velocity of point B on the train-arm and CT at the unit radius CA represents the number of revolutions per minute of the train-arm as compared with CP. Therefore,

$$N = \frac{CP}{CT} = \frac{4}{3} \text{ and } N_1 = \frac{3}{4}, \text{ approximately}$$

In the geometrical solution it is only necessary to find the ratio of $\frac{CP}{CT}$, where CP may be taken as unity in starting the solutions of the several right triangles shown in Fig. 4.

Given: $CP = 1$ and $CO = \frac{2}{3}$

$$\frac{ER}{CO} = \frac{EA}{CA} \text{ or } \frac{ER}{2/3} = \frac{30}{12} \text{ or } ER = \frac{5}{3}$$

$$BM = \frac{ER + CP}{2} = \frac{5/3 + 1}{2} = \frac{4}{3}$$

$$\frac{CT}{BM} = \frac{AC}{AB} \text{ or } \frac{CT}{4/3} = \frac{12}{21} \text{ and } CT = \frac{16}{21}$$

$$N = \frac{CP}{CT} = 1 \times \frac{21}{16} = \frac{21}{16}, \text{ and } N_1 = \frac{16}{21}$$

Since the driving sun wheel D_1 makes 96 revolutions per minute, the follower train-arm will make $\frac{16}{21} \times 96$ revolutions per minute or $73\frac{1}{7}$ revolutions per minute. From the foregoing figures it follows that the train-arm AB runs 23.8 per cent slower than the drive wheel D_1 and 14.28 per cent faster than the auxiliary internal drive wheel D_2.

Solved by the analytical method, this problem is a little more complicated than the previous ones, due to the fact that the assigned velocities of the two wheels are in terms of each other, and neither is given in terms of the train-arm, which is the follower. The train-arm, it will be recalled, is the member of the mechanism on which the time unit is based in considering the relative velocities. In previous problems, the data were so given that the assigned velocities could be used directly and throughout the analysis in terms of the train-arm velocity.

If all parts of the mechanism are rotated once as one solid piece about A, Fig. 4, then there will be one turn of the initial driver D_1 for one turn of the train-arm, or $N_1 = 1$. If D_2 is treated for the present as a fixed wheel in the operation of the mechanism, it must now be turned all the way back, giving $N_1 = 1 + \frac{60}{18} \times \frac{18}{24} = \frac{7}{2}$. Then, if D_2 is turned $\frac{2}{3} \times \frac{60}{18} \times \frac{18}{24}$ or $\frac{5}{3}$ times, the train-arm will be advanced and will have turned $1 + \frac{5}{3} = \frac{8}{3}$ times. Therefore, the number of turns of the wheel D_1 to one turn of the train-arm will be $N = \frac{7}{2} \div \frac{8}{3} = \frac{21}{16}$ or $N_1 = \frac{16}{21}$. All of this is expressed in the formula

$$N = \frac{1 + \frac{60}{18} \times \frac{18}{24}}{1 + \frac{2}{3} \times \frac{60}{18} \times \frac{18}{24}} = \frac{21}{16} \text{ or } N_1 = \frac{16}{21}$$

This means that if the sun wheel D_1 is driving 96 revolutions per minute and the internal wheel D_2 is also being driven in the same direction, at 64 revolutions per minute, the follower train-arm will make $96 \times \frac{16}{21} = 73\frac{1}{7}$ revolutions per minute.

The same result will be obtained if D_2 is considered as the initial driver and D_1 as the auxiliary driver. D_1 would then be turning at $\frac{3}{2}$ the rate of

D_2, and the formula would be written:

$$N = \frac{1 + \frac{24}{18} \times \frac{18}{60}}{1 + \frac{3}{2} \times \frac{24}{18} \times \frac{18}{60}} = \frac{7}{5} \times \frac{5}{8} = \frac{7}{8}, \text{ or } N_1 = \frac{8}{7}$$

N_1 is the number of turns of the train-arm to one turn of wheel D_2. Since D_2 was assigned 64 revolutions per minute, the follower train-arm AB will turn $64 \times \frac{8}{7} = 73\frac{1}{7}$ revolutions per minute, as found in the previous solutions.

Engineers Discuss Economic Problems

AT the annual meeting of the American Society of Mechanical Engineers, held in the Engineering Societies' Building, New York City, during the first week in December, practically every branch of mechanical engineering received attention, either by a whole session being devoted to it or through the presentation of papers or committee reports. In addition to the sessions devoted to purely engineering subjects, two, held jointly with the American Management Association, covered industrial stabilization and engineering economics.

At the business stabilization meeting, three able papers were presented, containing definite constructive proposals, which, if followed by industry, would prevent excessive booms and serious depressions to a great extent. The banker's viewpoint was presented by Paul M. Mazur of Lehman Brothers, New York, who dealt with the depression problem from the financial aspect. Mr. Mazur pointed out the defects in our banking system, which are all too obvious at the present time.

The question of unemployment insurance was dealt with by James W. Hook, president of the Geometric Tool Co., New Haven, Conn. Mr. Hook amplified the ideas on this subject that he expressed in an article in November MACHINERY. In his address, however, Mr. Hook went considerably farther than in the article referred to. He advocated group industry action under the guidance of the Department of Commerce. He expressed the hope that manufacturers will be willing to do voluntarily what it is the obvious duty of industry to do. It is only when voluntary action fails to produce the required results that government should need to step in and use its compulsory power.

Mr. Hook made it clear that carefully managed industries can carry their stable workers over periods of depression by setting aside comparatively small reserves during periods of good business. When all manufacturers in an industry set aside the same reserves, no competitive handicap is involved. In concluding his address, Mr. Hook said:

"What America needs, with its traditions of democracy and rugged individualism, is not more laws, but a considerate governmental leadership that, by encouragement and example, will teach its peoples and institutions the art and importance of cooperation. Only in this way can the composite mind of the whole people be brought to bear upon the confusing and unyielding problems of the present day, many of which reach to the very foundations of our civilization."

Calvin W. Rice, Secretary of the A.S.M.E., who was Made an Honorary Member at the Annual Meeting

The economic side of industrial stabilization was ably presented by Virgil Jordan, economist of the McGraw-Hill Publishing Co., New York City. Mr. Jordan particularly emphasized the importance of a properly planned public works program and of taxation as a means of stabilizing industry.

The engineering economics session dealt with dividend programs as related to depressions and with the economic life of equipment. Both of these subjects were discussed by engineers and accountants of wide experience, and covered the broad aspects of economics as applied directly to an engineering enterprise. A point made was that dividends are often paid at the expense of the depreciation account.

Calvin W. Rice, Secretary of the Society, Honored after Twenty-Five Years of Service

One of the features of the meeting was the annual dinner, upon which occasion Calvin W. Rice, for twenty-five years the secretary of the Society, was made an honorary member. When Mr. Rice came to the Society as secretary in 1906, he already had a fine record of engineering achievement as well as a record of unique accomplishments in engineering society work, including the important part that he played in the carrying out of the project for a United Engineering Societies' Building in New York City.

Adapting Machine Tools to New Jobs

Examples of Machines that Have been Adapted, by Simple Changes, for Different Work from that for Which They were Designed

By JOSEPH P. LANNEN, Tool Supervisor
Graham-Paige Motors Corporation, Detroit, Mich.

THE problem of finding new applications for machine tools taken off the jobs for which they were originally bought is one that frequently tests the resourcefulness and ingenuity of the tool designer. When changes are necessary in order to adapt machines to new operations, it is of vital importance to consider carefully the amount of money that must be expended to make the contemplated changes. Otherwise, the "changing-over" of machines may easily prove to be an uneconomical practice.

The present article gives a number of examples of machine tools that have been adapted successfully to new jobs in the plant of the Graham-Paige Motors Corporation.

New Application of a Single-Purpose, Planer-Type Milling Machine

The planer-type milling machine shown in Fig. 1 was originally purchased for milling the manifold side of cylinder blocks. This job required two vertical cutter-spindles located on a center line running at an angle of 45 degrees in relation to the center line of the table. When the operation was discontinued, it was decided to remodel the machine to adapt it for rough- and finish-facing the joint faces of cylinder heads in one operation.

For this new operation, it was necessary to bring the two cutter-spindles into line with the table travel. The cost of an entirely new spindle head was avoided by the use of two offset columns A and B, which provide for mounting the head so that the cutters are brought in line for taking the roughing and finishing cuts in succession.

A motor was installed at C for driving the feed mechanism, to which power was formerly transmitted by a belt connected to the spindle drive on the head of the machine.

Multiple-Spindle Drilling Machines Arranged for Tapping

A number of multiple-spindle drilling machines have been transformed into tapping machines by

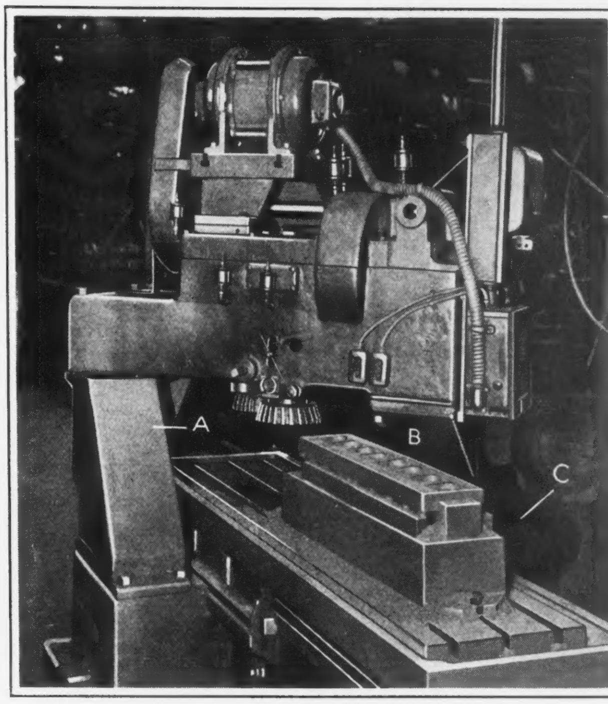


Fig. 1. Planer-type Milling Machine in which the Head was Remounted at an Angle to Bring the Cutters into Line for a New Job

the simple addition of a reversing switch A, Fig. 2, which is connected to the driving motor. This switch is tripped automatically when the spindle head of the machine has fed down to the desired depth. A large handwheel made of pipe is sometimes added to machines of this type to make it easy for the operator to raise and lower the drill head. Tap chucks are substituted for the drill chucks. The machines must, of course, be slowed down to the correct tapping speed.

Hydraulic Feeding Mechanisms Applied to Two Machines

Fig. 3 illustrates a multiple-spindle drilling machine that was originally equipped with a mechanical feed for the drill head. To meet certain needs, the machine has been provided with a standard hydraulic mechanism for feeding the table and work to the drills and for returning the table rapidly at the end of the operation. The results obtained have fully justified the expenditure made.

Fig. 4 shows a machine used for spot-facing the seats for twelve valve springs in cylinder blocks at the lower end of the valve guide holes. The center distances between these holes, which are in six groups of two, are not great enough to permit the use of twelve cutters simultaneously. Therefore, the holes are spot-faced six at a time, the work being indexed crosswise to enable all holes to be finished in one operation.

This machine was originally a rail drilling machine furnished with a cam feed for moving the table to and from the drills. This mechanism has been replaced by hydraulic equipment. The hy-

draulic equipment automatically indexes the table crosswise to bring the first group of six holes into line with the cutters, rapidly traverses the table upward for spot-facing the work until a stop is reached, returns the work rapidly, indexes the table crosswise to bring the second group of holes beneath the cutters, traverses the work rapidly to the spot-facing tools a second time, returns the work quickly to the loading position, and stops the machine.

The hydraulic mechanism is operated by a cam at the rear of the machine, which is mounted on a worm-gear shaft, formerly used to raise and lower the table. One revolution of the cam produces the full cycle just described. There is no slow feed for cutting, the table being raised to the stop at the rapid traverse speed. Each cutter-spindle telescopes, and is fed downward by spring pressure. This provides each spindle with an individual feed, and is a feature that has greatly increased the cutting life of the tools.

Honing Machine Adapted for Multiple Chamfering Operation

A six-spindle honing machine, rearranged for chamfering the bottom of cylinder bores, is shown in Fig. 5. The spaces between the main bearings of the cylinder block are too narrow to permit circular chamfering tools to pass through. Hence, the tools are flattened on the sides. When the tools enter the work preparatory to cutting, and when they are withdrawn at the end of the operation, it is necessary for the spindles of the machine to be in the proper angular position—that is, with the flat sides of the tools parallel to the ends of the main bearings.

After the cylinder casting has been placed in the machine with the spindles stationary in the proper angular position, the table raises the cylinder rapidly to the cutting position. At this point the spindles commence turning and the work is then fed slowly to the cutters. When the cuts are completed, the spindles stop in the correct position to permit the table to lower the cylinder block for reloading.

This operation cycle is entirely automatic, the table being actuated through a cam driven by an individual motor. The cam is designed to give a rapid advance, slow feed, dwell, and quick return. The motor for driving the spindles is started by a limit switch, and it is stopped with the spindles in the correct position through a switch working in series with a commutator on one of the spindles. Quick stopping of the motor is effected by a switch which throws reversing current into the motor until it is stopped.

There is no danger of damaging this machine, either through ignorance on the part of the operator or through improper functioning. If the tool-spindles are not correctly positioned to enter the

Fig. 2. A Reversing Switch Applied to This Multiple-spindle Drilling Machine Converted it into Tapping Equipment

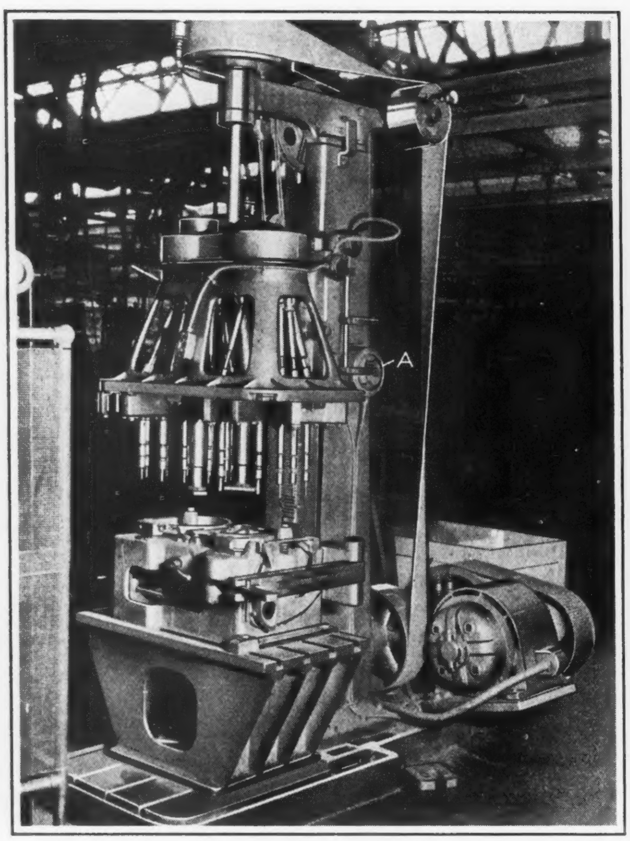
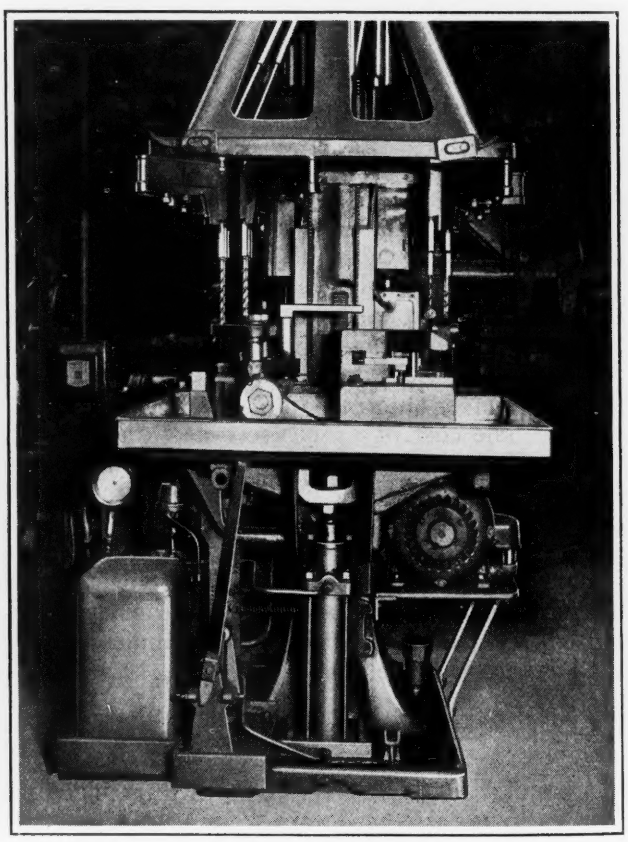


Fig. 3. Hydraulic Equipment for Actuating the Table Replaced the Original Feeding Mechanism of This Machine



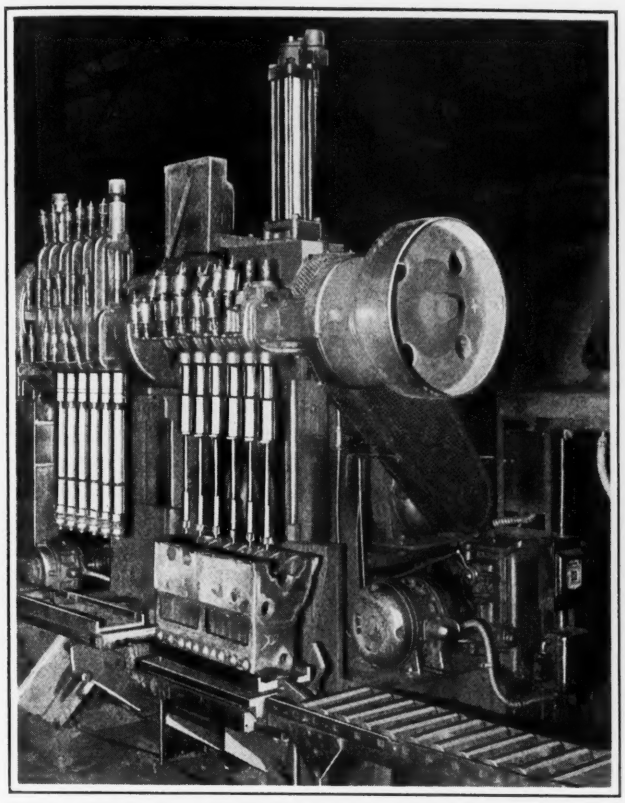


Fig. 4. Automatic Vertical and Crosswise Table Movements are Obtained on this Equipment by a Hydraulic Mechanism

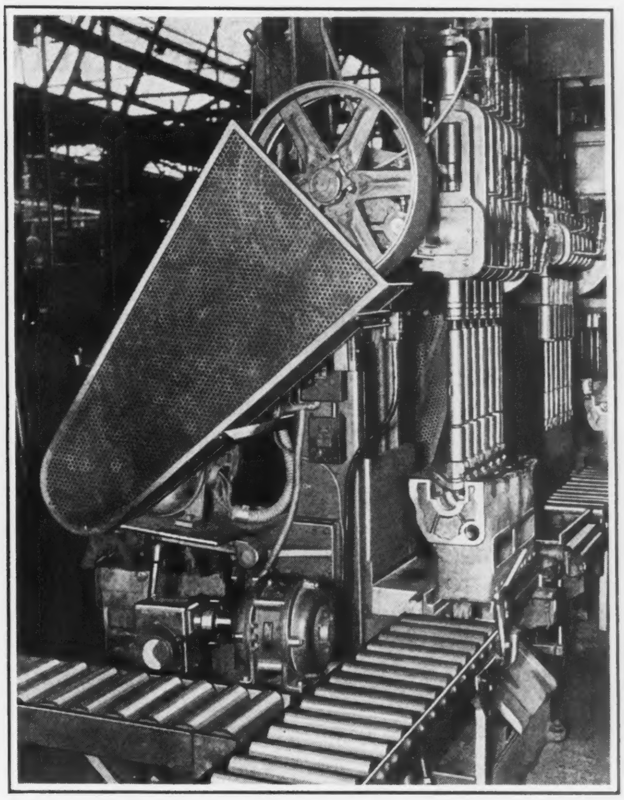


Fig. 5. The Cutters Used in this Machine for Chamfering the Cylinder Bores Must be Stopped in a Certain Angular Position

cylinder block, the machine cannot be started, and if the spindles do not stop correctly upon the completion of the cuts, the table will not be lowered. A shear pin in the feed mechanism prevents breakage in case the table should start to rise with the spindles incorrectly positioned. All the automatic movements are accomplished electrically, and the interlocking features are obtained through the use of switches, relays, etc. The only mechanical additions were new spindles, the holding fixture, and a motor-driven speed reducer for the feed mechanism.

The machines illustrated in Figs. 4 and 5 are located beside each other in the cylinder machining line, and they are attended by one operator. The total time required for changing the cylinder blocks in both machines is twelve seconds.

Increased Sales Efforts Make a Dent Even in a Depression

In a recent address, Frederick M. Feiker, director of the Bureau of Foreign and Domestic Commerce, pointed out that in a study of 358 industrial and business firms that have made material progress during the depression in maintaining or increasing their sales volume and profits, it was found that in 254 instances increased sales efforts and aggressive advertising policies were the outstanding reasons assigned for the success of these firms.

One manufacturer stated that he "ignored the depression and sold machines"; the result was an increase in business in a depression year. In case after case, the manufacturers reported that their successful efforts had been made possible because they undertook to analyze their markets and to concentrate their sales efforts where effort would count.

Of course, figures and facts alone will not do the job—statistics will not take the place of business judgment, and sales estimates will not produce sales—but success in business today depends more than ever upon the use of detailed essential facts.

* * *

Seven all-welded Diesel-electric locomotives have been constructed by the General Electric Co. for switching service at the Bush Terminal, New York City. While the engines and electric equipment follow the usual standards of design, many new features are incorporated in the framework because of the use of welding. The complete structure of cab, under-frame, and trucks is fabricated from structural steel shapes and plates, and is arc-welded throughout.

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

IT is not necessary for a foreman to wear himself out worrying about the mistakes of his men if he will adopt a simple method of showing each man what his mistakes mean in dollars and cents. A card file can be used for this purpose, the mistakes of each man that result in scrapped material or expense being recorded on the cards.

Every foreman has some men who continuously make mistakes. They do not respond to the foreman's efforts to teach them, and reprimanding them does not seem to be effective. To show such men at regular intervals how much their mistakes have cost the company in dollars and cents, by presenting the actual record to them, is usually effective. The men will understand, without being told, that some day the company may think they are too expensive to have around.

HARRY KAUFMAN

Leaving the Foreman Free to Do Important Work

In one plant that has been very successful in reducing costs, a system has been put into effect for increasing the efficiency of foremen. To free the foreman from unnecessary interruptions, so that his time and attention can be given to his work, signal lights, operated from the foreman's desk in his office, are installed in the shop, and are used to call the sub-foremen into the office. In this way, the foreman saves the time required for locating them.

In this shop, the foreman also has a chart of the capacities of all the machines in the department, so that he can route work from his desk by simply using the chart and the blueprints, without having to look at the actual job and the machine. The men in the shop deal with the sub-foremen, and the foreman is troubled with requests for assistance only when the problems are such that the sub-foremen cannot deal with them. This has given the foremen more time to consider ways and means of speeding up production, improving quality, and reducing scrap.

K. H.

Marking Steel for Identification

Tool steel manufacturers could facilitate the use of their product if they would stamp each bar of steel at regular intervals with a symbol to indicate whether the steel is water-hardening or oil-hardening, and also to show the correct hardening and tempering heat. For example, if a steel were marked O-15-4.5, this would indicate that it is oil-hardening, that the proper hardening heat is 1500 degrees F., and the tempering heat 450 degrees F. Similarly, W-14-5 would indicate a water-hardening steel, requiring 1400 degrees F. hardening heat, and 500 degrees F. tempering heat. I believe that marking of this kind would save much expense in the shop.

I have broached this subject to steel salesmen, but it has been contended that the plan is not a feasible one. Of this I am not convinced, however, and would like to know what the industry thinks of this idea. The opinions of both steel users and steel manufacturers would be of value in this connection.

F. H. RAUH, Superintendent
J. Wiss & Sons Co., Newark, N. J.

Profiting by Reading Technical Journals

Many employers find it difficult to induce their foremen and other employes holding important positions to improve their knowledge by reading technical journals regularly. In one instance, this difficulty is being overcome in the following manner: The company subscribes for a leading technical magazine on behalf of those men in the organization that will benefit most from increased knowledge of the methods used in the industry in which they are engaged. Each month the works manager himself goes over his copy, making note of every article that should be of value to any one of the foremen or designers. He then writes an office memo to the man in question, asking his opinion on the article mentioned. In this way, he makes it necessary for the man to read the article, and also to give it some thought in order to express an opinion about it.

The works manager states that this plan has proved to be highly valuable, and at a recent engineering meeting, made the statement that he would not exchange this method of training the men in his employ for any other method used in industry. He said that it had increased the alertness of his men and their value to the company in a definitely measurable degree.

CHARLES R. WHITEHOUSE

To handle men correctly requires more thought and study than to master a complicated machine.—*The Shop Review*

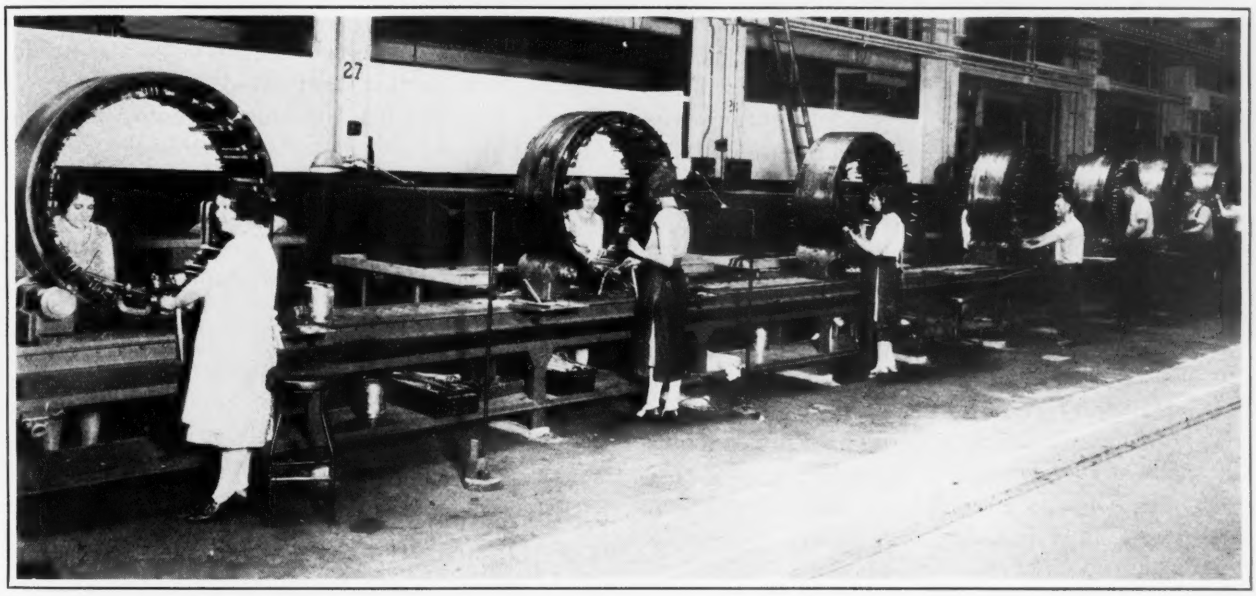
Notes and Comment on Engineering Topics

The Westinghouse Electric & Mfg. Co. practices what it preaches in electric welding applications. Huge electrical machines are fabricated by welding in this plant, and the total welded output of the Westinghouse shops is estimated to be 12,000 tons annually.

On several occasions, we have made mention of the electric eye—the photo-electric tube. One of the latest developments in the electrical research field is the "electric ear," by means of which noises can be detected, recorded, and compared. The "electric ear" consists of a condenser microphone, amplifier, rectox, and a sensitive meter. Among the purposes for which this device is used is that of measuring the sound of electric refrigerators. Since motor-driven devices have become generally used in the home, there has been a demand for a higher degree of silence than has ever before been expected of machinery.

For the first time in the history of watchmaking the need for a temperature compensating device such as has been used in the past in connection with the hair-spring has been eliminated. This simplification of the watch mechanism and the increase in its accuracy have been made possible by manufacturing hair-springs of Elinvar, a nickel-steel alloy invented and developed by Dr. Guillaume, who received the 1920 Nobel award in physics for his achievements in the perfection of alloys, notably Elinvar and Invar.

As the elasticity of Elinvar remains constant, irrespective of temperature variations, hair-springs made from this material are uniform in action at any temperature at which the watch may be used. It is obvious that this alloy is of great importance not only in watches, but in any kind of precision instrument requiring a hair-spring or a part that is impervious to temperature variations.



Straight-line Production Methods are not Confined to the Automobile Industry. At the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. Straight-line Assembly Methods are Used for the Electrical Equipment of the Ninety New Electric Locomotives for the Pennsylvania Railroad

A second quality of Elinvar of especial importance is that it cannot be permanently magnetized. In a watch, this permits making the balance wheel of a non-magnetic metal. Two American watch manufacturers—the Hamilton Watch Co., Lancaster, Pa., and the Illinois Watch Co., Springfield, Ill. —are already making their railroad-type watches with Elinvar hair-springs and solid-rim non-magnetic balance wheels. These companies have the exclusive patent rights for the United States, and are in a position to license other manufacturers to use Elinvar in watches and precision instruments.

The Stalingrad tractor plant in Russia reports a production of over 100 tractors a day.

EDITORIAL COMMENT

Industry Has a Real Problem to Solve One of These Days

When Dean Barker of Columbia, in his annual report to the president of the University, emphasized the need of a broader outlook in engineering education and pointed out that technical knowledge is no longer the chief asset of an engineer, he struck a note of the greatest importance to American industry.

The most important problem to industry and to engineers is no longer production. For the present, at least, we have solved the production problem. In fact, during the last two years we would have been able to produce at least 50 per cent more than necessary to meet the existing demand.

The great problem confronting industry now is the human problem. The problem of stable employment has come to overshadow that of production; yet the two questions are closely interwoven. Other things being equal, it is possible to employ men at better wages when production is efficiently handled.

The proposals that have been made to limit production by returning to less efficient methods, as, for example, to do road-building without the use of modern machinery, are shortsighted. It is only by improved means of production that we can raise the general standard of living. That problem being solved, our next problem is in the field of economics —to see to it that those who produce are in a position to acquire and use all that they produce, so that the wheels of industry may be kept revolving.

Spending Profits on Unprofitable Lines

Almost all businesses face the difficult problem of deciding to what extent they should limit themselves to the manufacture of their most profitable lines and how far they should go in building complete lines and carrying complete stocks in order to satisfy occasional customers. There is no doubt that in a great many cases the profits made on the types, models, or units most generally in demand are lost in carrying and pushing lines that are unprofitable.

An extreme example of this came to our attention recently. It has to do with the industry that manufactures threading tools. One of the plants in this industry made an investigation a few years ago to separate the more profitable items from those that were less profitable. It was found that the company had made 55,000 different kinds of threading tools in the last few years. Of these, 2000 types represented 80 per cent of the sales volume, while 53,000 represented only 20 per cent. Furthermore, it was found, upon narrowing the inquiry to 400 sizes, that these 400 represented 72 per cent of the sales volume. Yet the unit selling price, size for size, was the same on the 400 profitable items as on the 54,600 items which, under the circumstances, must be put down as unprofitable.

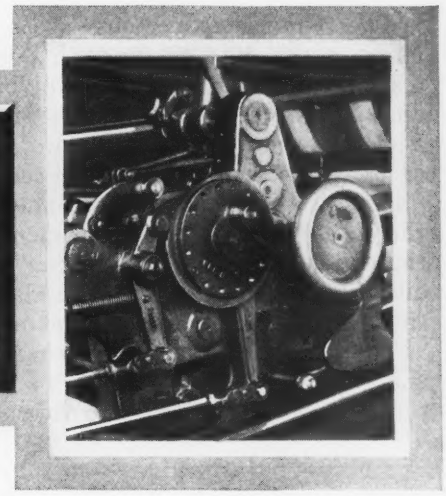
These facts were submitted to all the manufacturers in the industry, and a number of competitors confirmed the findings. The Division of Simplified Practice of the Department of Commerce then took the next step in cooperating with the industry, with the result that the sizes kept regularly in stock were reduced to only 200, while other sizes and types were placed on a special basis to be sold at an additional price, so that they would yield some profit. This made it possible to reduce inventory, including finished goods, raw material, and work in process, to less than one-half of what it had been in the past, so that there were four and one-half inventory turnovers per year instead of approximately two. This, in turn, meant reduced capital investment.

Beauty in Machines is as Desirable as in Buildings

The question of appearance in machine design is being emphasized by one of the largest users of machine tools and other shop equipment. This manufacturer is making a "drive" for smooth castings and "smoothness" in the appearance of the entire design. For example, where the corners or edges of two castings meet, they must match evenly; motor brackets must fit the motors; all corners must be generously rounded and all curves smooth and even. The castings must be free from surface blemishes.

All this, obviously, is desirable. Beauty in machine design should be just as valuable as beauty in architecture. But there is one point that must not be overlooked; the buyers of machine equipment must remember that perfection in appearance is not a matter of chance, but can be obtained only by painstaking effort and labor. In other words, it costs money; and the buyer who makes a point of appearance must be prepared to pay for it. Some of the features of a good-looking design are no more expensive than those of an ugly design; but others are. The increased cost may be well worth while, but somebody must pay it.

Ingenious Mechanical Movements



Positive Clock-Controlled Intermittent Mechanism

By JOSEPH WAITKUS

The mechanism shown in Fig. 1 is used in a bottle-cap counting machine recently added to the production equipment of a large firm. It is the function of this mechanism to swing a pivoted chute alternately from one position to another, allowing the chute to remain in each position long enough to permit a packing case to be filled with bottle-cap crowns which are delivered by the chute. Although the movements obtained with the mechanism here illustrated could be duplicated by other mechanical arrangements, none of the available types met the particular requirements of the counting machine. On the other hand, the mechanism here described has proved so successful that the writer believes that others may find it useful, either in its present or in a modified form.

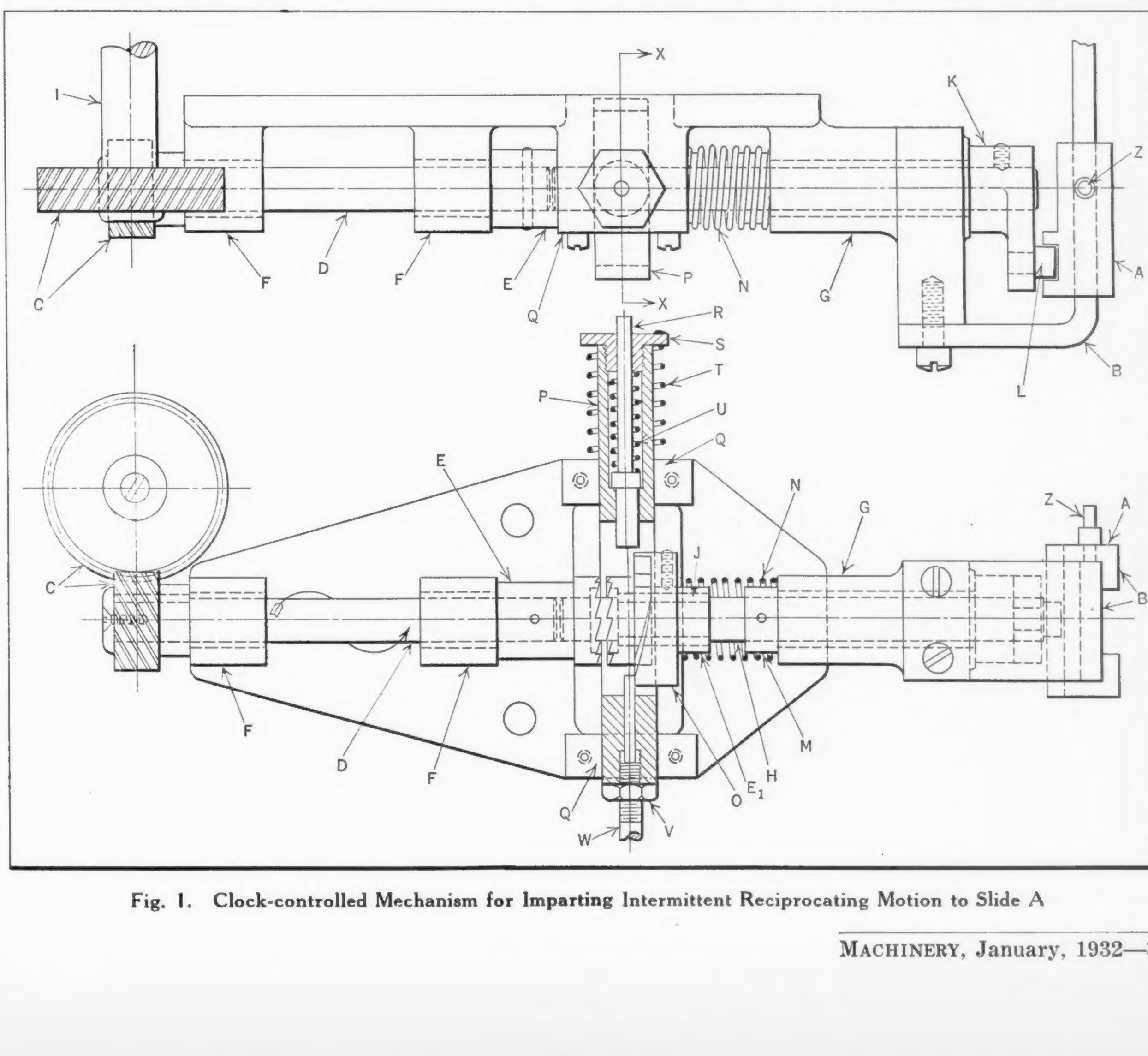


Fig. 1. Clock-controlled Mechanism for Imparting Intermittent Reciprocating Motion to Slide A

The required movements are transmitted to the chute by the slide A. The pin Z in slide A engages a slot on the under side of the pivoted chute. When slide A is in the position shown in the upper view, Fig. 1, the chute discharges into one of the packing cases. As soon as the packing case is filled, a clock, having its actuating lever connected to rod W of the yoke P, releases the latter member, which causes the clutch to engage the driving and driven shafts and then disengage them after the driven shaft has carried the crank-arm K around one-half revolution.

The pin L of the crank-arm engages a slot in slide A and carries the slide to the opposite position, where it remains while the packing case under the chute is being filled. The clock then acts again, and the chute is automatically transferred to the other filling position. This cycle of operations is repeated continuously, the mechanism being driven by the constantly rotating shaft I through the helical gears C and shaft D. With this arrangement, the transfer movement of the chute is accomplished very quickly and smoothly. The timing of the movements and the duration of the rest periods are controlled by the clock, which can be adjusted to meet any operating requirements.

Referring now to the construction of the mechanism, the toothed clutch member E is fastened to the continuously rotating shaft D, mounted in the bearings F. The second portion of the mechanism is supported in the bearing G, and consists of shaft H, on which the toothed clutch member E_1 is a sliding fit. Rotation of E_1 on shaft H is prevented, however, by the two small feather keys J, which are fixed in the shaft and are a close sliding fit in the keyways in E_1.

The crank-arm K, previously referred to, is fastened to the outer end of shaft H. The collar M prevents any lateral movement of the shaft and at the same time serves as a guide for the spring N. When the mechanism is released, the spring N forces the clutch element E_1 into engagement with element E, thus providing for the positive rotation of the crank K through one-half revolution.

The cam O, which causes the slide A to pause at the end of each stroke, or one-half revolution of shaft H, is fastened to the clutch element E_1. The contour of cam O, when rolled out in a flat position, is shown in the views to the right, Fig. 3. It will be noted that there are two gradual rises in the cam surface, after which a sudden drop follows. These drops are just 180 degrees apart.

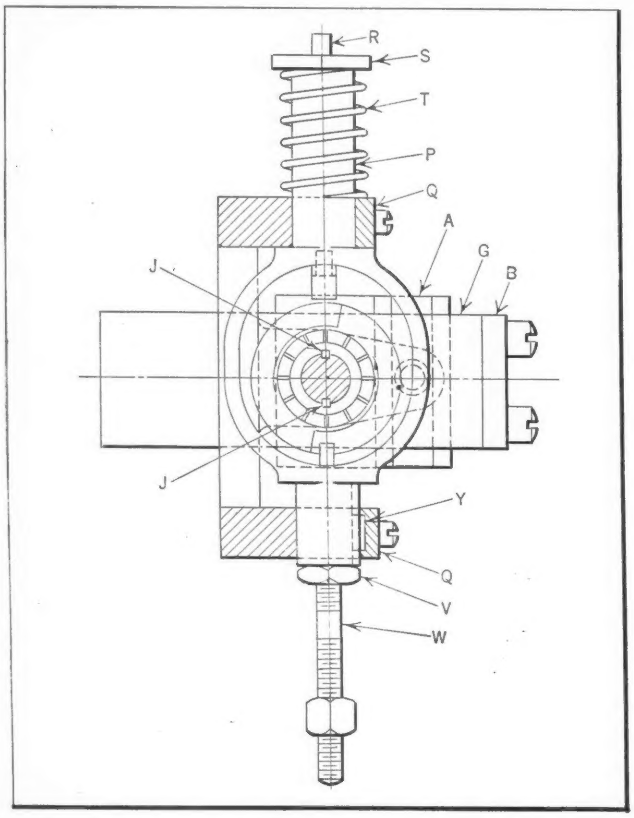


Fig. 2. Section X–X, Fig. 1

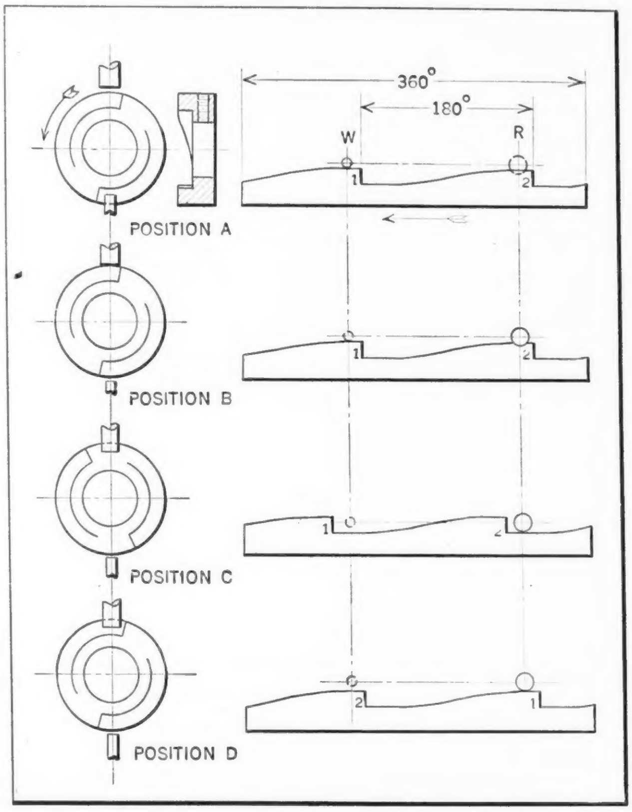


Fig. 3. Form and Operation of Cam O, Fig. 1

To disengage the clutch elements, it is only necessary to move the clutch element E_1 a certain distance, depending upon the depth of the clutch teeth plus a reasonable amount of clearance between the teeth. In this case, the depth of the teeth was 1/16 inch. The rise of the cam contour was 7/32 inch, giving a clearance between the teeth of 5/32 inch. This large clearance is necessary, as will be made clear from the following description of the cam followers. The cam, which is machined in the form of a ring, is fastened to the clutch element E_1 by a

set-screw, so that these two members are free to move laterally along the shaft H.

The cam follower arrangement is somewhat more elaborate than the average type of follower, and is the most interesting and unique feature of the mechanism. Some question may be raised as to the application of the term "follower" here, but the term seems to apply as well as any. Referring to Figs. 1 and 2, the yoke P is guided in the bearings Q. These bearings are split for the purpose of facilitating the assembling of the mechanism. To prevent the yoke from rotating in its bearing, a small key Y is provided and a keyway is cut in the lower stem of the yoke. This restricts the yoke to a vertical movement.

The lower stem of the yoke is provided with the adjustable pin follower W, which may be locked in place by nut V. The adjustment of this pin is very important, as it determines the amount of movement necessary in the lever mechanism (not shown here), which is attached to the pin follower W. This lever mechanism is connected to the clock that times the movements. The clock-operated mechanism will remove the lower pin and permit the clutch elements to make contact under the action of the spring N. The upper stem of the yoke is counterbored and provided with the plunger pin follower R and the light spring U, which is held in place by the nut S. The spring T keeps the yoke in the upper position with its shoulder against the lower side of the bearing Q.

The function of the two pin followers will be more easily understood by referring to the four diagrams in Fig. 3, which show the main positions of the pin followers with relation to the cam contour. At A is shown the normal position of the pin followers at the starting position. The lower pin is in contact with the cam contour, while the upper pin is free. As soon as yoke P, Fig. 1, is pulled downward, the lower pin is removed and the upper pin strikes the outer edge of the cam ring, as shown in position B, Fig. 3.

It will be noted that the upper pin is larger in diameter than the lower one. The purpose of this feature will become obvious on further consideration of the mechanism. When the upper pin strikes the outer edge of the cam ring, the spring U, Fig. 1, is compressed. However, this condition only exists momentarily, inasmuch as the spring N forces the clutch elements into contact as soon as the lower pin is removed from the cam contour, resulting in the rotation of the cam and all its attached parts.

As soon as rotation begins, the upper pin is freed and drops down under the action of the spring U, so that it makes contact with the cam contour as illustrated in position C, Fig. 3. When the cam has rotated 180 degrees, the clutch elements are separated and the rotation ceases. This last step is illustrated by position D, where the point marked 1 has been replaced by the point marked 2 under the upper pin follower R. In the meantime, the crank has traversed from one end of its stroke to the other and stopped. The lower pin is still out of contact with the cam contour, the upper pin having performed the action of separating the clutch elements. As soon as the yoke is released, it is raised by the spring T, Fig. 1, and at the same moment, the upper pin is removed from the cam contour and replaced by the lower pin. This explains the necessity for having the upper pin slightly larger in diameter than the lower one.

The upper pin causes the cam contour to move, or be set back slightly from the edge of the lower pin follower. This permits the lower pin to rise freely into position opposite the cam contour. The cam and the clutch member E_1 move toward the clutch member E as the upper pin leaves the contour of the cam, but this movement is stopped by the lower pin.

Two very important details should be noted. First, the distance between the ends of the upper and lower pins must be such as to bring the lower pin opposite the cam contour before the upper pin is entirely removed from contact with the cam. If this condition does not exist, the spring N will force the clutch elements into contact before the lower pin is in place to hold it back when the upper pin is removed. The second important detail is to note that the rise of the cam contour is determined by the size of the upper pin. The upper pin must obviously be able to fall in with the lower part of the cam contour before it can perform its function.

If the yoke is released before the cam has rotated through 180 degrees, the lower pin itself will perform the function of separating the clutch elements and leave the upper pin inactive as far as contact with the cam is concerned. In this particular case, there was no absolutely definite time release for the yoke, so that a positive operating arrangement had to be provided which would allow a rotary motion of only 180 degrees at each releasing movement of the yoke P, regardless of how long the yoke was held in the lower position. This feature accounts for the use of two cam followers instead of one.

It might be of interest to mention here that this mechanism is operated at a speed of about 100 revolutions per minute with no difficulty. However, it might be necessary to provide small depressions in the surface of the cam contour at the points where the followers rest if the speed is much above 200 revolutions per minute. This will prevent overrunning of the cam due to the inertia developed in the rotating parts.

* * *

The present appears to be an excellent time to consider equipment policies. If there is any feature of an industry that should be covered by a good policy it is the equipment; for the equipment is the capital investment and must be kept intact as to value if the industry is to survive, or its loss in value due to time and wear must be accumulated elsewhere. An accurate equipment policy is an integral part of an accurate cost finding system, and no enterprise is safe that does not possess both.—*Dean Dexter S. Kimball*

The Successful Suggestion System of the Pennsylvania Railroad

How a Great Railroad System Has Achieved Remarkable Results in Enlisting the Cooperation of its Employes in Every Department

THE Bureau of New Ideas was established by the Pennsylvania Railroad in November, 1927, "to encourage new ideas and suggestions from employes for improving the service, increasing the efficiency of operation, and advancing the interests of the company and its working forces." The plan was inaugurated in further recognition of the capacity of its employes for intelligent observation and sound, constructive thinking. The Bureau provides an effective and practical method not only of getting employes' ideas into circulation, but also of putting to mutually advantageous use the experience, observation, and wisdom of employes in all departments, to the end that the best possible service might be rendered to the public.

It is generally realized that with their daily intimate contact with the details of operation, employes have opportunities for observation and thought on which to develop constructive ideas, and the plan under which the Bureau is operated avoids any possible embarrassment to the employe submitting a suggestion that is found impracticable. Every employe is invited to send in any idea that he believes will help to improve the efficiency of operations, better the service, save time, effort, or material, expedite repair work or eliminate its necessity, or otherwise promote mutual interests.

Results of the Pennsylvania Railroad Suggestion System

Period	Number of Suggestions			
	Received	Finally Acted Upon	Adopted	
			Number	Per Cent
Two Months, 1927.......	750	314	15	4.8
Year 1928....	1497	1772	177	10.0
Year 1929....	2504	2206	419	19.0
Year 1930....	2440	2584	851	32.9
Eleven Months, 1931.	1834	2022	660	32.6
Total to Date	9025	8898	2122	23.9

Employes Show Interest in a Carefully Planned Suggestion System

The wide interest displayed by Pennsylvania employes is demonstrated by the fact that suggestions have been received from men in 229 different payroll classifications, representing every department of railroad work and every portion of the railroad system. The accompanying table evidences the continuing interest of employes in the plan.

How Adopted Suggestions are Rewarded

In addition to money awards paid regularly to individual employes whose suggestions are adopted, "special" cash prizes have been awarded at the close of each six months' period for the three best suggestions adopted during the period, the awards being based on a combination of original thought displayed, saving effected, and improvement in methods, operations or service. The first prize is $100, the second prize $50, and the third prize $25. Twenty-four such special prizes have been awarded thus far to men engaged in the following occupations: Boilermaker helper, brakeman, clerks, conductors, crossing watchman, electricians, enginemen, fireman, laborer, machinists, pipe fitters, store attendant, and tinner.

Because the employes are spread over such a wide territory, it was concluded that the "Suggestion Box" arrangement that has worked out satisfactorily in many of the factories and plants of manufacturing companies and others where arrangements of this kind are in effect would not be suitable, and therefore on the Pennsylvania Railroad the employes submit their ideas in writing, mailing them direct to the Bureau, which is at the headquarters in Philadelphia.

The employes put their suggestions in writing (no special forms being required), explaining as fully as possible just what the idea is, how it will work, and what the employe thinks it may accomplish. Prompt acknowledgment of each suggestion is made as it is received.

All Suggestions are Treated as Confidential

All suggestions are considered confidential, and the name of the author is not known even to those officers to whom a copy of the suggestion is sent for consideration; an employe's name, whether or not his suggestion is adopted, is never disclosed by the Bureau unless his permission is obtained.

Letters received from employes indicate that many worthwhile suggestions are submitted (which would otherwise be withheld) because of assurance of confidential handling. An employe naturally hesitates to submit suggestions to his immediate

superior when he feels somewhat uncertain as to the practicability of his idea.

Every suggestion is given careful and impartial consideration by those qualified to pass upon its merit. When a conclusion is reached, the employe is advised in a letter mailed to his home address; in case his suggestion is not adopted, the reason for its rejection is explained.

With perhaps a dozen exceptions, all the suggestions received are designed to increase efficiency or economy in certain details of the maintenance, repair work, or other features of operation, or to otherwise improve the service to the public. Subjects concerning the employes alone are handled by them through channels otherwise provided.

Careful Records are Kept of All Suggestions

The Bureau keeps a careful record of the subjects of suggestions and the authorship. In line with the experience of some of the manufacturing companies and others who operate suggestion systems, it has been found that due to changes in conditions, an idea not practicable or feasible at the time, may later be found desirable, in which event an endeavor is made, to notify the employe who originally proposed the arrangement.

It is the Pennsylvania's experience that the Bureau of New Ideas is inspiring many employes to use latent powers of observation and analysis, encouraging and developing constructive thinking, and providing additional opportunity for self-expression. The recognition on the part of management of the capacity of the employes for intelligent observation and sound thinking encourages and develops more careful thought and observation in the performance of duty, use of materials and supplies, etc. It has a tendency to inspire greater and more sustained interest in efficiency and progress, and further develops a recognition of mutual interest.

An Explanation Stating Why a Suggestion Cannot be Adopted Promotes Good Will

Explanations made in reply to suggestions that are not adopted undoubtedly broaden the viewpoint of thoughtful serious-minded employes, and in many instances tend to restore confidence in methods and practices that were previously questioned by uninformed or misinformed employes.

The following paragraphs are extracts from typical letters received from employes:

"I gratefully acknowledge receipt of your letter of September 26, and cannot begin to tell you of the 'boyish' delight it gave me to know that I had in a measure accomplished something besides my daily tour of duty."

"I am glad to see that my suggestion has been adopted and want to thank you for your cooperation; also the token. It is an honor to be associated with a corporation that gives its employes this opportunity; this is the attitude that creates good will and loyalty and reflects the character of one of the greatest corporations (if not the greatest) in the world."

"I want you to know that I appreciate the thorough going over which my suggestions have been given, as shown by the correspondence. This of itself is sufficient encouragement."

The following quotation from a letter from an employe whose suggestion was not adopted brings out a rather interesting reaction and also reflects the care used in advising employes when their suggestions are not considered practicable or desirable:

"Thank you very much for your thoroughly comprehensive letter of April 9 in regard to my suggestion regarding . . . Your letter discloses an angle to this proposition I had not heretofore taken into consideration, which makes me more pleased at the non-acceptance of my suggestion than if same had been adopted; and I am glad to have had this view presented to me."

All suggestions are handled and answered with due regard for the cooperative spirit that prompts their submission. While this involves the expenditure of time and thought for those suggestions not found worthy of adoption, the Pennsylvania management is of opinion that the tangible as well as the intangible value of the plan has demonstrated it to be a worthwhile medium for encouraging and recognizing constructive interest on the part of the employes in the company's progress. The results show a steady growth in the spirit of cooperation which the management is aiming to encourage.

* * *

An Exhaustive Report on Tungsten-Carbide Tools

A report pertaining to tungsten carbide and other hard cutting materials was presented before the American Society of Mechanical Engineers at its recent annual meeting in New York. The report was prepared by Coleman Sellers, executive engineer of William Sellers & Co., Inc., Philadelphia, Pa. It contains a summary of the answers to a questionnaire sent out to leading manufacturing establishments throughout the country.

The questions answered deal with the extent of applications; the types of operations found successful with tungsten or tantalum carbide; the types of materials on which these tools have been used successfully; grinding, lapping, and honing of tools; detection of hard spots; handling of chips; protection from flying chips; obtaining desired finish; method of tipping; angles of clearance and rake; and method of mounting tools. Typical examples of savings on different types of machines are also included in the report, which may be obtained by addressing the American Society of Mechanical Engineers, 29 W. 39th St., New York.

* * *

Behind the curtain of immediate problems of business is a junk pile of worn-out and obsolete ideas.—*Frederick M. Feiker, Director, Bureau of Foreign and Domestic Commerce*

Indicator Test Gages for Ball-Race Seats

Testing the Depth from the Face of an Automobile Crankcase to the Seat of a Ball Bearing Race is Accomplished Quickly and Accurately with the Special Gages Here Described

By PHILIP F. SHAFRAN

THE depth gages shown in the accompanying illustrations were designed for the purpose of checking the ball-race seats in automobile crankcases. Fig. 1 shows an indicator for testing the ball-race seat *Y*; this seat is more than 11 inches from the finished face *X* of the open end of the crankcase, which is more than 10 inches in diameter. The ball-race seat, as may be seen in Fig. 1, is eccentric relative to the bore or face *X*, so that only a small arc can be measured on the shoulder of seat *Y*. This is, however, sufficient to meet the requirements of the gage.

The gage consists of a casting *A*, comprising a knurled handle, two arms, and a hub. The arms are turned slightly smaller than the bore at *Z* and are faced to provide a stop against the face of the housing *X*. Two hardened and ground steel strips *H* are fastened to the stop shoulders of casting *A* to reduce wear. A hole is bored in the hub of the casting to receive the steel tube *B*. A recess is also bored in the casting at right angles to the hub and handle to provide a nest for the dial gage *D*. The dial gage rests on a flat seat in the recess, and is held down by two screws (not shown). A hole larger than the stem of the indicator provides clearance for the stem and spindle. A hole is also provided in back of gage *D* to provide clearance for the spindle when it is depressed and projects at the other end.

The handle is made hollow to reduce the weight. Tubing *B* carries the long rod *C*, one end of which is in contact with the point of indicator *D*, while the other end is turned down and rounded for use as the gaging point. A hardened and ground bushing *J* is pressed on the front end of spindle rod *C*. This bushing provides a shoulder for the light compression spring *I*. Spring *I* is required because the spring in the dial indicator is too light to return the long spindle *C* after depression.

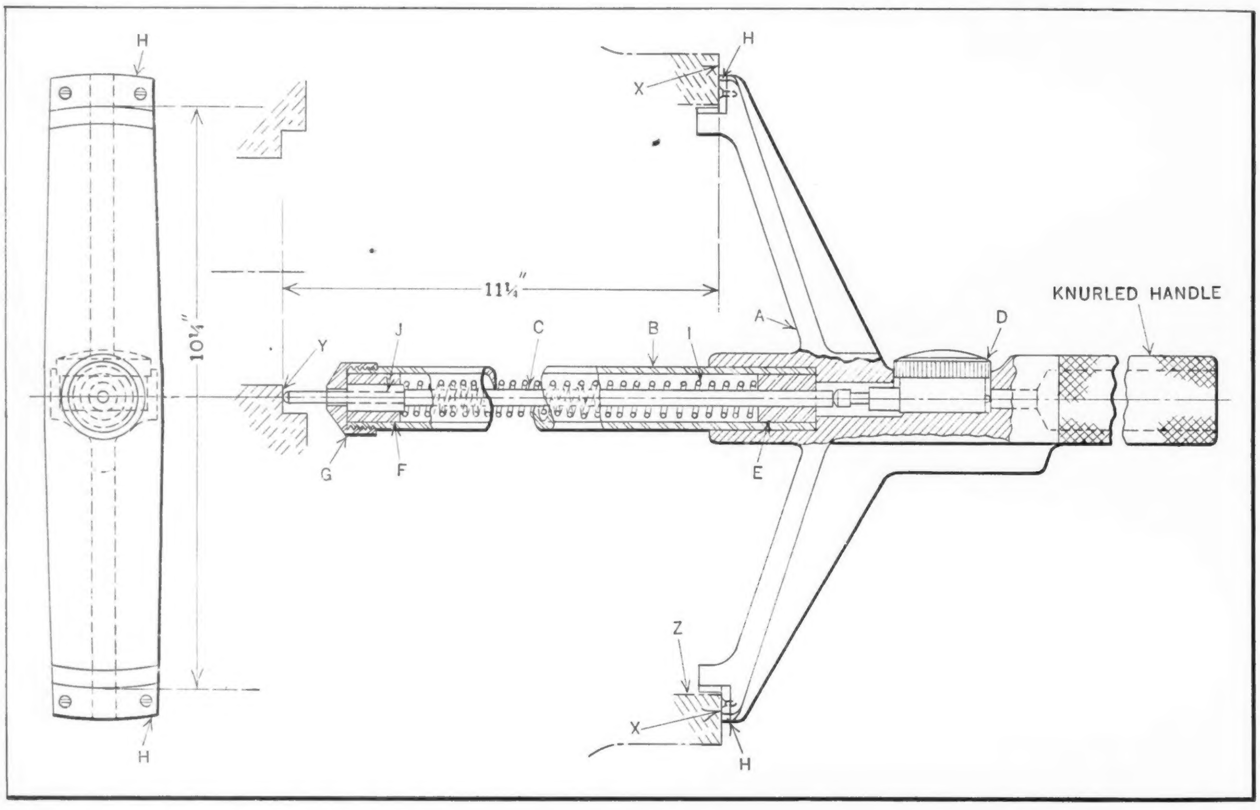


Fig. 1. Gage with Dial Indicator for Testing Depth of Ball-race Seat below End Face of Crankcase

Spindle *C* is supported in hardened and ground bushings *E* and *F*, which are a press fit in tube *B*. Cap *G* retains the spindle rod *C* and spring *I*. The thin arms of casting *A* are reinforced by a central rib, as shown. The lower rib is extended under the indicator seat to reinforce the portion weakened by boring the seat for indicator *D*. The bezel ring of indicator *D* extends partly above the nest to allow

for setting the gage to the zero mark.

Fig. 2 shows a modification of the end of the gage seen in Fig. 1. This arrangement permits testing a ball-race seat that is concentric with the bore from which it is being gaged. The casting with the knurled handle and the other parts used for this gage are the same as for the gage in Fig. 1. The shoulder of the ball-race seat *Y* to be gaged is about 3 inches below the center of spindle rod *C*. The gaging is accomplished by means of levers *L* and *M*, which are housed in the casting *K*. Casting *K* is bored to fit over the end of tube *B*, and is held firmly by set-screw *P*. The end of spindle rod *C* enters the lever housing and makes contact with lever *L*. Levers *L* and *M* are held in position by shoulder screws *Q*, but are free to turn on these screws. The light spring *N* tends to keep lever *L* against the end of spindle rod *C*. The lever housing is covered by the sheet-metal cover *O*.

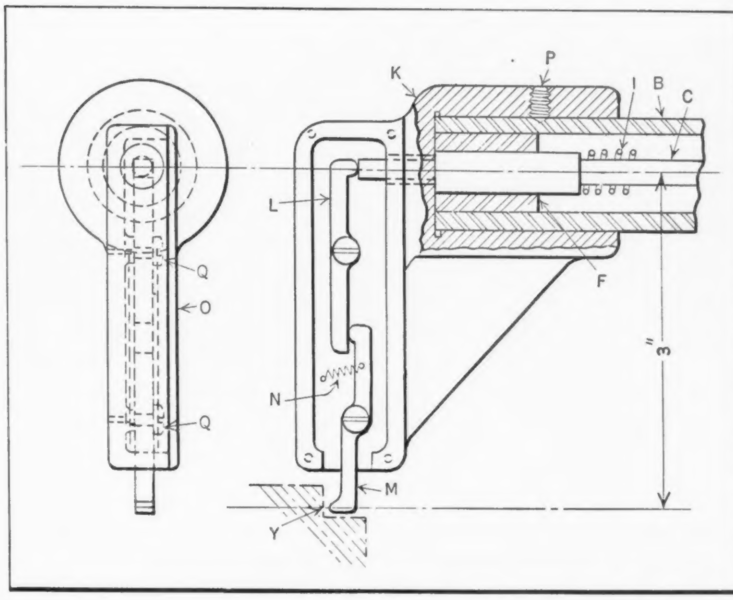


Fig. 2. Offset Attachment Applied to Spindle End of Gage Shown in Fig. 1

The third gage, shown in Fig. 3, is used to test the depth of a ball-race shoulder from a finished flange on the outside of the housing, as shown in the illustration. This gage consists primarily of a cast-iron frame *R* and the three pins *S*, pressed into bosses on the casting. The pins *S* are hardened and ground on the contact ends. Levers *L* and *M* serve the same purpose as in the gage shown in Fig. 2. The dial indicator *D* is the type having a spindle that extends through the bottom of the gage, perpendicular to the face. The portion of casting *R* marked *f* is turned slightly smaller than the front bore of the housing being checked, to facilitate locating the gage on the work. The three openings in casting *R* serve the double purpose of reducing the weight and providing a convenient hand-grip.

In Fig. 4 is shown the type of master gage used for setting the gages shown in Figs. 1 and 2. It consists of a cast-iron frame *A*, two hardened plates *B*, and one hardened plate *C*. Faces *H*, Fig. 1, of the indicator are placed on plates *B* of the master

Fig. 3. Gage for Testing Depth of Ball-race Shoulder from Flange

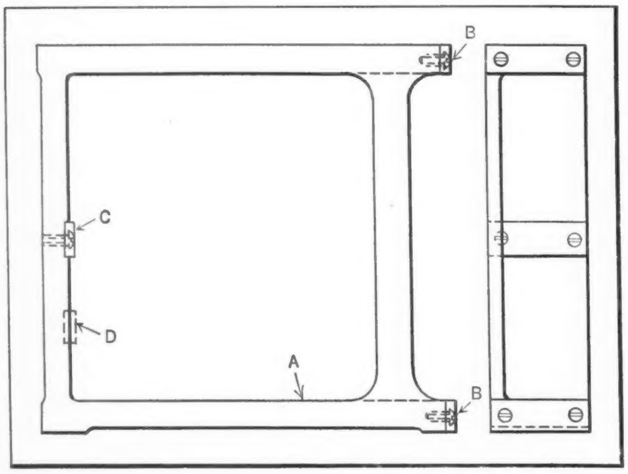


Fig. 4. Master for Setting Dial Indicators of Gages Shown in Figs. 1 and 2

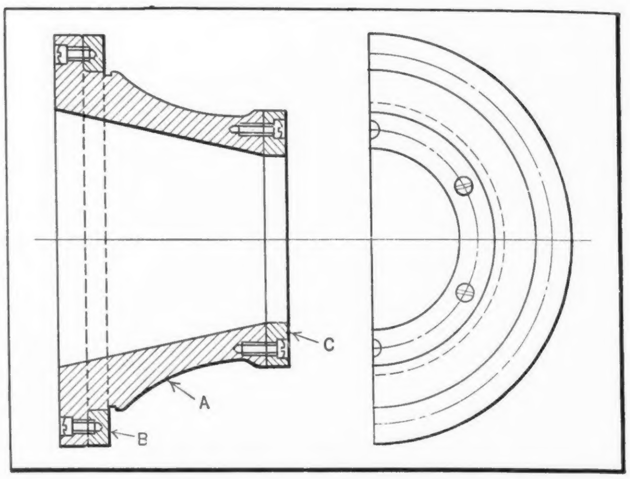


Fig. 5. Master for Setting Indicator of Gage Illustrated in Fig. 3

gage. Adjustments are made by turning the bezel of the indicator to bring the zero mark under the indicating needle. The dotted outline at *D* shows the approximate location of plate *C* for the indicator shown in Fig. 2.

Fig. 5 shows the master used for setting the gage shown in Fig. 3. Casting *A* (Fig. 5) is turned and faced to receive two hardened and ground steel rings *C* and *B*. The three pins *S* (Fig. 3) of the gage rest on ring *B* (Fig. 5) while the indicator point of lever *M* (Fig. 3) makes contact with ring *C* (Fig. 5).

Solving a Problem in Gas Consumption

How an Engineer Determined the Amount of Gas Required to Maintain the Oil in a Heat-Treating Tank at a Given Temperature

By GEORGE P. PEARCE

"WE are figuring on a job that will mean a year's production for Department M, but in order to get it, we must quote a close figure. There is one item on which we have no past experience, and this cost I want you to figure out for me," said Mr. Maxwell, the manager, to Mr. O'Brien, the superintendent.

"You know that old dipping tank in Department M—the one that is mounted on a brick base? Well, we would have to use that for a special heat-treating process. It would be filled with oil to within 6 inches of the top and would have to be heated up to 600 degrees F. by 8 o'clock every morning. Then we would run 1500 pounds of steel parts through it every hour until quitting time. The 600-degree temperature would be maintained by a thermostat so the steel would all be brought up to that temperature. The fuel would be gas, and the gas is maintained at 600 B.T.U. per cubic foot and would cost us $1 per thousand cubic feet.

"Now what I want to know, O'Brien, is this: How much will the gas for operating this heat-treatment tank cost us per year?"

"Well, give me until this afternoon and I'll have some figures for you," answered the superintendent, who, as a matter of fact, was bewildered as to how to tackle the problem.

The superintendent hurried over to Jack Hughes, the plant engineer. "Jack," he said, "the boss wants to know how much gas it'll take to run an oil heat-treating tank. How in thunder do you figure these things?"

"Well, how big a tank and how much oil?" asked Jack, picking up his slide-rule.

"He's going to use the old dipping tank in Department M. That tank is 6 by 4 by 2 feet deep. The oil will come to within 6 inches of the top."

"All right," said Jack, giving the slide-rule a couple of pushes, "that makes, say, 300 gallons of oil. How hot does he want it?"

"It's going to be kept at 600 degrees by a thermostat."

"Well, let's see—300 gallons at about 7.55 pounds per gallon will make 2262 pounds of oil, and the specific heat of that oil is, say, 0.48. The rise in temperature above that of the room will be 530 degrees, so it will take $2262 \times 0.48 \times 530 = 575,000$ B.T.U. to bring it up to the operating temperature."

"Now divide that by 600 and that'll give the number of cubic feet of gas to get it heated," suggested the superintendent.

"No it won't, because all the time it's being heated the tank is also cooling off, so more gas will

be needed to balance that. You see the four sides of the tank, with an area of about 40 square feet, will lose considerable heat."

Turning to a text-book, the engineer found that at a temperature difference of 530 degrees F. there would be a radiation loss of about 2600 B.T.U. per square foot per hour, or about 104,000 B.T.U. per hour, while the tank is at 600 degrees F.

"Then," said the engineer, "on top of this there will be the radiation from the surface, or, say, about 3000 B.T.U. per square foot; this, multiplied by 24 square feet, will give another loss of 72,000 B.T.U. That will make a total radiation loss of 104,000 + 72,000 = 176,000 B.T.U. per hour all day long. Of course, the first hour it will not radiate that much because it is heating up. If it gets up to temperature in an hour, we could say that the radiation loss will be 100,000 B.T.U. and not be far wrong."

"All right, then the heat required for the first hour will be 100,000 + 575,000 = 675,000 B.T.U.," agreed the superintendent, jotting the figures down. "Now what about the working hours? There will be 1500 pounds of steel going through that tank every hour."

"Well, let's check up on that. The specific heat of steel at 600 degrees is about 0.12, so the steel will absorb 1500 × 0.12 × 530, or 95,500 B.T.U., and this added to the radiation of 176,000 B.T.U. will make 271,500 B.T.U. each working hour," explained Jack.

"Fine," acknowledged the superintendent enthusiastically, also jotting that down. "Now we can divide by 600 and—"

"Wait a minute," interrupted the engineer. "What about the noon hour? The thermostat will keep the tank at 600 degrees so there will be 176,000 B.T.U. more to add. That will make, for a working day, 675,000 + (271,500 × 8) + 176,000, or 3,023,000 B.T.U. Then, on Saturday, there will be 675,000 + (271,500 × 4), or 1,761,000 B.T.U. This will make a total of 16,876,000 B.T.U. per week of five and one-half days."

"Now" began the superintendent, "all we have to do is to divide that by 600 and—"

"Wait a minute," again interrupted the engineer. "You aren't going to get all the heat out of that gas. In the first place, the waste gases will leave the tank at about 1000 degrees F., so they will carry a lot of heat with them. A pound of gas will require 18.15 pounds of air for combustion and the specific heat of the waste gases will be about 0.26 and their temperature above the room is 1000 — 70 or 930 degrees. Therefore, the heat carried away in the 18.15 pounds of air plus 1 pound of gas will be about 19.15 × 0.26 × 930 = 4625 B.T.U. Now there is approximately 24.2 cubic feet of gas to the pound, and so a pound of gas has 600 × 24.2 = 14,500 B.T.U. This pound of gas, however, will only be able to deliver 14,500 — 4625 = 9875 B.T.U. into the oil. Thus, you see, the heating value of your gas in this case is only 9875 ÷ 24.2, or 408 B.T.U. per cubic foot. Quite a difference!"

"I'd have entirely missed that," admitted the superintendent.

"Now take 16,876,000 ÷ 408 = 41,355 cubic feet, and that is how much gas you will burn per week."

The superintendent now figured rapidly, and allowing for the fortnight vacation shutdown, found that 41,355 × 50 = 2,068,000 cubic feet of gas, which was the amount that would be needed per year.

"That," said O'Brien, "will increase our gas bill by over $2000 a year. It figures $2068, and that's the cost I'm after."

* * *

Increasing Interest in Arc Welding

We are informed by the Lincoln Electric Co., Cleveland, Ohio, that the increased interest in welding at the present time is reflected in the large number of papers that were received by the judges in the second Lincoln arc-welding prize competition, which has been referred to several times in MACHINERY. In this competition, $17,500 was offered in prizes for the best papers on redesign for arc-welded construction. The number of papers entered in the 1931 contest was four times as great as in the first contest.

Interest in this contest has been international in scope, with sixteen foreign countries represented, Germany, France, England, and Australia submitting a remarkable number of papers. It is believed that the perfection, in the last two years, of arc-welding technique and the now widely recognized economy of arc-welded construction has stimulated engineering interest in the economies and efficiencies possible with the process.

* * *

Meeting of the Taylor Society

The Taylor Society held its twentieth annual meeting at the Hotel Pennsylvania, New York City, December 2 to 4. Economists, bankers, and government officials, as well as business and industrial leaders, discussed the causes of the present world depression and offered recommendations for business stabilization through scientific planning. One session was devoted to "Power and Mechanization as Causes of Depression." Another subject that evoked much discussion was "The Responsibility of the Church for the Solution of Industrial Problems."

* * *

Meeting of Institute of Weights and Measures

At the annual meeting of the American Institute of Weights and Measures, 33 Rector St., New York, on December 2, Dr. W. R. Ingalls was re-elected president, and William E. Bullock, secretary. Luther D. Burlingame, of the Brown & Sharpe Mfg. Co., presented a paper on the history and status of the inch.

Brazing Metals with Silver Solders

Silver Solders Find Extensive Application in the Automotive and Electrical Industries

By A. EYLES

BRAZING with modern silver solders is extensively employed in the automotive, electrical, and other industries for joining metal parts when greater strength is required than can be obtained by soft-soldering or when the parts have to withstand a temperature that would cause soft solder to melt. Silver-soldering is also used in cases where the high temperature developed by electric or oxy-acetylene welding would seriously distort parts adjacent to those that are being joined. Parts fabricated from brass, bronze, or copper or even thin sections of steel, such as tubing, band saws, etc., can be joined so effectively by brazing with silver solder that the joint will be approximately as strong as the material itself.

Factors that Control Strength of Brazed Joint

The mechanical strength of silver-solder brazed joints depends largely upon the nature of the solder used, the depth to which the solder penetrates, the temperature at which the brazing is done, the thoroughness with which the metal surfaces to be joined are cleaned, the correct manipulation of the torch flame, and the proper use of suitable fluxes.

Although the alloys employed are called silver solders, their function is that of a brazing medium, as they are generally applied by means of oxy-acetylene, air-acetylene, atmospheric coal gas flame, or some brazing appliance of the Bunsen burner type. The process of brazing with silver solders can be applied successfully to brass, bronze, copper, Monel metal, nickel, iron, steel, including stainless steel, or combinations of these metals. The fundamental advantage of silver solder is the freedom with which it will melt and flow into joints to form a close, neat joint, the strength and reliability of which exceeds that of soft-soldered or spelter-brazed joints.

Silver-soldering is commonly thought of as expensive, whereas for many purposes it will prove an economical method because of the quick, free-flowing properties of the silver solder, the sparing way in which it can be used, and the fact that joints thus produced require very little finishing. In fact, it is actually the cheapest method of making many of the joints required in the automotive, electrical, chemical, silverware, dairy, musical, optical,

Fig. 1. Extruded Bronze Brazed with Silver Solder and Bent Cold as Shown

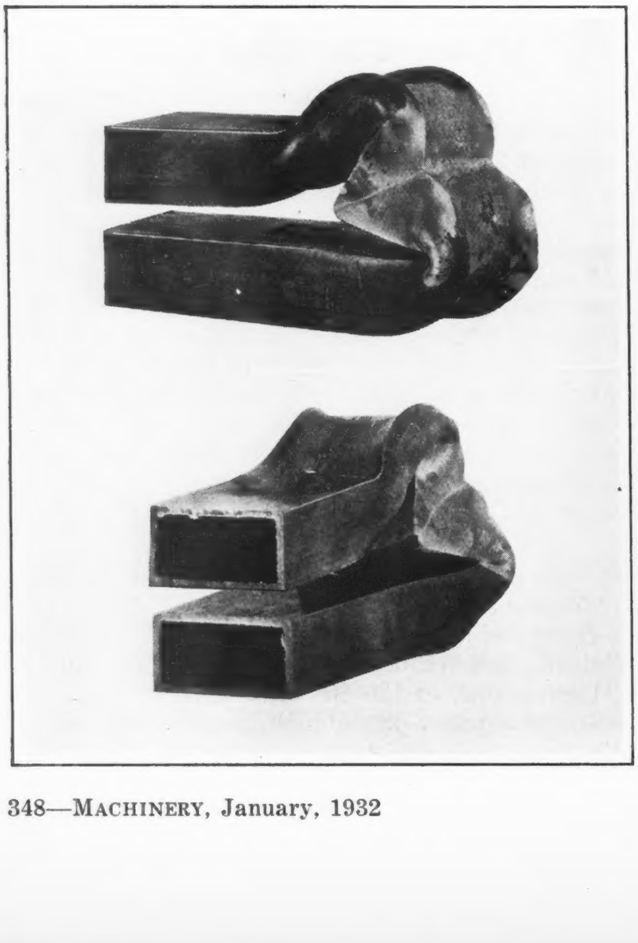


Fig. 2. Brazing Connections in Squirrel-Cage Type of Motor with Silver Solder

Table 1. Composition of Silver Solders

Silver, Per Cent	Copper, Per Cent	Zinc, Per Cent	Cadmium, Per Cent	Melting Point, Degrees F.	Flow Point, Degrees F.
65.0	20.0	15.0	....	1280	1325
65.0	20.0	12.5	2.5	1275	1325
65.0	20.0	9.0	6.0	1310	1345
65.0	20.0	5.0	10.0	1320	1370
65.0	20.0	....	15.0	1350	1385
20.0	45.0	35.0	....	1400	1510
20.0	45.0	30.0	5.0	1400	1485

and surgical instrument manufacturing industries, and for general engineering work where superior strength, neatness, ductility, leak-proof joints, and resistance to bending stresses, shock, vibration, corrosion, and relatively high operating temperatures are primary considerations.

Aircraft manufacturers, who subordinate everything to the safety factor, use silver solders in brazing parts of aircraft or motors that are subjected to vibration or are likely to encounter relatively high operating temperatures. Typical uses in this field are the joining of push-rod bushings, thermo-couples, brass connections, and fittings of copper fuel and oil-pipe lines, connections for control wires and cables, etc.

Melting and Flow Temperatures of Silver Solders

Silver solders are made in sheet, strip, wire, and granular form, and in a number of different grades of fusibility, the melting points of silver solders varying between 1250 and 1600 degrees F., according to the percentages of silver, copper, and zinc that they contain. The temperature at which the solder becomes liquid is usually called the melting point. Some of the constituents in all the alloys melt at lower temperatures than others, and in this article the term "melting point" refers to the temperature at which any part of the alloy starts to melt. The term "flow point" refers to the temperature at which the solder is entirely liquid. Usually, only the flow point is of particular interest, but when a second brazing or soldering operation is needed, it is desirable that the solder used for the first operation have a melting point above that of the flow point of the solder used for the second brazing operation. The difference in temperature between the melting point and the flow point varies according to the composition of the alloy.

For a given ratio of copper and zinc, the addition of silver will lower the flow point. By using as much as 65 per cent silver, it is possible to produce a silver solder that will flow freely at approximately 1300 degrees F. A further increase in the percentage of zinc reduces the flow point to 1250 degrees F. Conversely, those alloys containing lower amounts of silver will have correspondingly high flow points unless the zinc contents are abnormally high, in which case the alloy will be brittle. It is evident, therefore, that malleable and ductile silver solders having low flow points must have relatively high percentages of silver.

For ordinary uses, an alloy that flows at a temperature slightly above 1400 degrees F. consists of from 40 to 50 per cent of silver, with the proportions of zinc and copper in about the same ratio as in common brass. For approximately the same silver content, the percentage of zinc can be increased until it is equal to that of the copper, in order to give a lower flow temperature. There seems to be some prejudice against the use of the higher zinc solders, although numerous tests have shown that when proper care is taken, they will give satisfactory joints. The silver-copper alloy that contains approximately 72 per cent silver and 28 per cent copper has a melting point of approximately 1435 degrees F.

How the Addition of Various Metals Affects Silver Solder

The effect on the flow point obtained by the substitution of cadmium for zinc depends upon the

Table 2. Physical Properties and Electrical Conductivity of Silver Solders

Approximate Composition, Per Cent					Specific Gravity, as Cast	Physical Properties, as Cast		Electrical Conductivity	
Silver	Copper	Zinc	Cadmium	Nickel		Tensile Strength, Pounds per Square Inch	Elongation, Per Cent in Two Inches	Conductivity, (Copper, 100 Per Cent)	Resistance, Microhms Per Cubic Centimeter
9.0	51.0	40.0	...	...	8.55	48,000	16.0	20.5	8.33
20.0	45.0	30.0	5.0	...	8.80	53,000	12.0	24.4	7.69
25.0	52.5	22.5	...	...	8.94	......	....	24.4	7.69
30.0	38.0	32.0	...	...	8.86	......	....	24.4	7.69
40.0	30.0	28.0	...	2.0	9.04	......	....	16.8	10.17
40.0	36.0	24.0	...	...	9.11	57,800	6.2	19.7	8.65
45.0	30.0	25.0	...	...	9.15	......	....	19.0	8.97
46.0	38.5	15.5	...	...	....	49,900	9.0	....	....
47.0	29.0	24.0	...	...	....	58,500	16.0	....	....
50.0	28.0	22.0	...	...	9.22	......	....	19.7	8.65
50.0	32.5	17.5	...	...	....	55,500	9.0	....	....
50.0	34.0	16.0	...	...	....	......	....	24.1	7.04
60.0	25.0	15.0	...	...	9.52	64,300	7.7	20.5	8.33
65.0	20.0	15.0	...	...	9.60	64,800	34.0	21.3	8.01
70.0	30.0	....	...	...	....	57,500	25.0	....	....
70.0	25.0	5.0	...	...	....	50,300	9.5	....	....
70.0	20.0	10.0	...	...	9.76	......	....	26.7	6.41
72.0	28.0	....	...	...	9.95	......	....	77.1	2.24
75.0	20.0	5.0	...	...	9.92	......	....	38.1	4.48
75.0	22.0	3.0	...	...	10.03	41,800	5.3	53.4	3.20
80.0	16.0	4.0	...	...	10.05	50,100	16.0	45.8	3.73
100.0	....	....	...	...	.....	......	....	106.7	1.60
.....	100.0	....	...	...	.....	......	....	100.0	1.71

composition of the alloy. In alloys containing 65 per cent or more of silver, the flow point is slightly raised, but in alloys containing relatively low percentages of silver, the substitution of 4 to 5 per cent cadmium lowers the flow point. This will be seen by reference to Table 1. It is also possible to produce malleable alloys of medium silver content with a higher percentage of combined cadmium and zinc than with zinc alone, thus giving slightly lower flow points.

The addition of tin in an appreciable amount lowers the flow point but it also tends to make the alloys brittle. Nickel hardens the alloy and raises the flow point. Lead and iron, even in very small quantities, are likely to cause difficulties. A mixture of 2 1/2 per cent silver and 97 1/2 per cent lead, to which a small amount of copper is added, is sometimes used as solder. This alloy has physical properties similar to those of soft solder, and should not be classed as a regular silver solder.

Tensile Strength of Silver Solders

The tensile strength of silver solders varies from 40,000 to 60,000 pounds per square inch. The tensile strength and elongation of a large number of bars having a cross-section of 0.100 to 0.300 inch are given in Table 2. These bars were cast in iron molds, and the rate of chilling was probably much more rapid than when the solders are used.

Often silver solder will make joints that are stronger than the metals joined. Fig. 1 shows sections of extruded bronze that were joined at their mitered ends by brazing with silver solder under an oxy-acetylene flame. Although the metal is only about 1/16 inch thick, the joint produced was so strong that it showed no sign of failure when the pieces were bent cold through 270 degrees.

Silver solders resist ordinary atmospheric corrosion, but as there are so many factors to be considered in corrosion problems, it is somewhat difficult to predict how they will stand up under varying conditions. In general, however, silver solders will resist corrosion as well as non-ferrous metals and alloys used in industry for their corrosion-resisting properties.

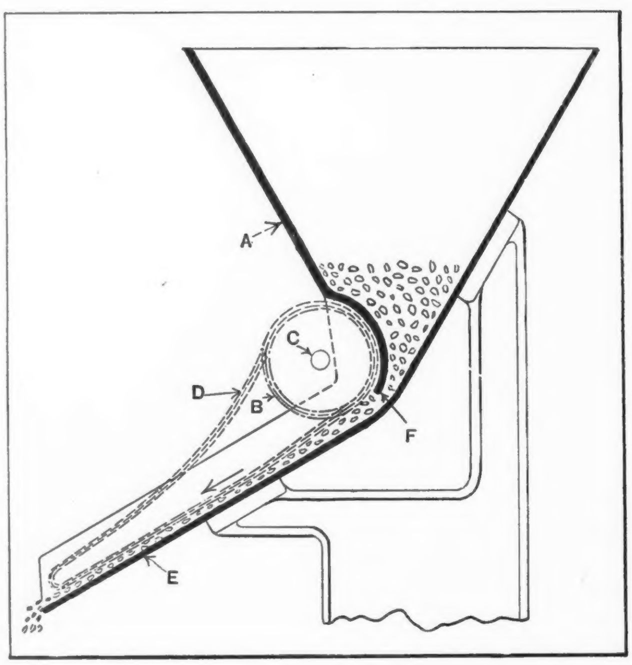
A valuable characteristic of silver solder is its high electrical conductivity. For this reason, silver solders, particularly those compositions having high percentages of silver, are very satisfactory for electrical work. Table 2 gives the comparative electrical conductivity of various compositions. The flux employed for silver brazing and the procedure followed in performing the brazing operations will be described in a later article.

The writer desires to express here his appreciation of the assistance given him by Handy & Harmon, New York, in furnishing illustrations and certain data for this and the succeeding article.

Mechanism for Feeding Granular Material

One of the methods used in a stamping mill for feeding crushed ore at a uniform rate to a grading machine is shown in the illustration. The ore, which consists of pieces about the size of an egg, is dumped into the hopper *A* and passes through the opening *F*. As the ore must be delivered from the chute *E* at a uniform rate, some means must be provided for regulating its flow. This is accomplished in the following manner: A number of endless chains *D* passing over the sprockets *B* rest upon the ore as it flows down the chute.

It is obvious that if there is no movement of the chains, the friction resulting from the weight of the latter will prevent the ore from sliding down the chute. If motion is imparted to the chain so that it will travel at a constant speed in the direction of the arrow, the ore will be carried downward at a uniform rate and at approximately the same speed as that of the chains. The movement of the chains is obtained by revolving the sprockets *B* on the shaft *C*, the latter being driven from the driving shaft of the grading machine. The nature of this ore is such that it will flow very freely, and little trouble is experienced from jamming at the mouth of the chute. J. E. F.



Maintaining a Constant Flow of Ore from a Hopper by Means of Endless Chains

* * *

According to a statement made by George Lewis, vice-president of the Arcturus Radio Tube Co., Newark, N. J., at a recent meeting of industrial engineers, there are 186 spot-welds in the final assembly of a radio tube.

Motorized Speed Reducers Simplify the Drive

Recent Departure in the Design of Speed Reducers Indicates a New Trend in Motor Drive Applications

TWO outstanding features of electric motors having built-in speed-changing units are compactness and accurate alignment of the armature shaft with the low-speed shaft. The design of these motorized speed reducers tends to improve the appearance of the machines in which they are used. There are several types of these speed reducers; they may be classified according to whether they are equipped with a worm-gear drive, a regular gear train with parallel shafts, or planetary gearing. In this article several different designs developed by various concerns will be described.

Worm-Gear Reduction Units are Available in Several Types

The claims made for the worm-gear type of reduction unit are that the drive is quiet in operation and well adapted for cases where the slow-speed shaft must be at right angles to the motor shaft and where a high speed ratio is essential. Units of this kind, as built by the Master Electric Co., Dayton, Ohio, are available in sizes from 1/30 to 10 horsepower and in speed ratios from 8 to 1 up to 72 to 1. The slow-speed shaft can be adjusted to any of four different positions by rotating the gear housing on the motor frame. Also, the motor frame itself can be mounted on the machine in a horizontal, vertical, or inclined position. Ball or roller bearings are used throughout.

Another type of gear reducer has a gear housing equipped with feet for fastening the entire unit to the machine. Thus the points of support are near the point of shaft overhang or load application. This unit is built by the Janette Mfg. Co., Chicago, Ill. The motors range in sizes from 1/30 to 3/4 horsepower, and in speed-changing ratios from 20 to 1 up to 78 to 1. When a drive on both sides of a unit is desired, a double slow-speed shaft extension can be provided, projecting either horizontally or vertically.

For very low speeds, the double reduction worm-gear units built by the Janette Mfg. Co. are suitable. In these units two sets of worm-gearing form the gear train, and both the slow-speed shaft and the armature shaft are parallel. Ratios as high as 2760 to 1 are obtainable. The intermediate worm-gear shaft can be built to extend from the housing, if required, so as to make two countershaft speeds available on the same unit.

Parallel-Shaft Units are Built to Either Reduce or Increase the Motor Speed

In the parallel-shaft type of speed reducer, the slow-speed shaft is parallel with the armature shaft. In the Master Electric Co.'s design, the slow-speed shaft is rotated by a pinion on the armature shaft, this pinion meshing with a larger gear on the slow-speed shaft. Both gear and pinion are ordinarily made of steel and are of the continuous herringbone type. However, when extreme quietness is essential, a composition gear is used. These units are built in sizes of from 1/30 to 20 horsepower. They are available in ratios up to 6 to 1 for speed reduction, and up to 1 to 2 for speed acceleration.

The gear housings can be rotated to any one of four positions, so that the slow-speed shaft is located either above, below, or on either side of the armature shaft. Ball bearings are used for the motor shaft, and roller bearings for the slow-speed shaft, allowing the motor frame to be mounted in a horizontal, vertical, or inclined position.

For lighter duties, a parallel-shaft type unit is manufactured by the Janette Mfg. Co., with horsepowers ranging from 1/10 to 3/4, and spur gear ratios from 2 to 1 up to 4 to 1.

Motor speed reducers with parallel shafts are also made by the Production Equipment Co., Cleveland, Ohio. These motors range from 1/2 to 40 horsepower. The slow-speed shaft is located at the same height as the center of the motor, but is offset at one side of the motor shaft. Helical spur gears are used in these units and ball bearings are provided for all shafts. The final speeds of the single-reduction type range from 200 to 900 revolutions per minute, and of the double-reduction type, from 20 to 180 revolutions per minute.

Parallel-Shaft Unit Equipped with Change-Gears

Geared motors having built-in speed-changing units are available with constant-mesh change-gears similar to those used in a lathe for varying the feed. In the Westinghouse-Wise multi-speed drive, built by the Westinghouse Electric & Mfg. Co. at the Nuttall Works, Pittsburgh, Pa., any one of four speeds can be obtained by shifting one lever while the motor is running at full speed and under load. The horsepower of the motor remains constant for all speeds. These motors are built in sizes from 1/2 to 15 horsepower, and the drives can be supplied with two-, three-, or four-speed motors to give eight, twelve, or sixteen different output speeds. The reduction ratios in the gear unit permit operation at speeds varying from actual motor speed to approximately one-third the motor speed.

Planetary-Gear Speed Reducers

Any standard motor from 1/6 to 75 horsepower can be converted to a speed-changing unit type by

replacing the regular head on the shaft side with a special planetary speed-changing unit. Planetary gearing permits a large speed reduction with few parts; hence, it is well adapted for geared-head motor units where economy and compactness are essential. Units of this type are built by the Watson-Flagg Machine Co., Paterson, N. J. Nine standardized ratios are available for motors of from 1/6 to 75 horsepower, operating at armature speeds up to 3600 revolutions per minute. The slow-speed shaft is in line with the armature shaft. A balanced-thrust, internal-helical gear system is employed, and Bakelite planet pinions provide a smooth and quiet gear action.

Motors with built-in planetary gear trains are also built by the Shepard-Niles Crane & Hoist Corporation, Montour Falls, N. Y. These units range from 1 1/2 to 35 horsepower ratings for direct current, and from 1 1/2 to 50 horsepower ratings for alternating current. Seven reduction ratios ranging from 5 to 1/2 up to 13 to 1 are available for each armature speed. These units can be equipped with electric brakes, making them suitable for hoisting machinery.

Planetary Gear Unit that can be Converted to a Right-Angle Drive

Horizontal and vertical planetary geared-head motors in capacities ranging from 1/2 to 20 horsepower and with slow-shaft speeds ranging from 50 to 400 revolutions per minute are built by the Production Equipment Co., Cleveland, Ohio. The horizontal type is applicable to practically any machine. The vertical type, while having many other uses, is well adapted for driving agitators in pulp and chemical mixing machines. A special spiral bevel gear box is also available for adapting this unit to a right-angle drive, this type having slow-shaft speeds from 10 to 135 revolutions per minute.

Double Planetary Gear Train for Large Speed Reductions

Planetary geared-head motors equipped with double planetary gearing permit unusually high reduction ratios. Units of this type are built by the Shepard-Niles Crane & Hoist Corporation. The current, horsepower, and armature speeds are the same as for the units already described, with the exception that a second planetary gear train is provided to obtain a greater reduction of speed. Any one of seven reduction ratios ranging from 30 to 1 up to 70 to 1 are obtainable for each armature speed. A special planetary gear train is also available, which gives any one of seven reduction ratios ranging from 20 to 1 up to 52 to 1. These reduction units can be used with motors of various makes by using adapter rings between the motor frame and the gear housing.

Planetary Gear Unit Adapted for Agitator Drive

Vertical agitator shafts are usually driven at a comparatively slow speed. Former methods of driving these shafts have been greatly simplified by a special agitator drive built by the Philadelphia Gear Works, Philadelphia, Pa. It consists of a geared-head motor of the planetary type mounted vertically on a cast-iron pedestal which is bolted to the top of the agitator tank. The parallel-shaft type of gearing is also available with these motors. These units can be obtained in sizes ranging from 1/4 horsepower to 50 horsepower and with ratios ranging from 4 to 1 up to 150 to 1.

Planetary Gearless Adhesion Units for Reducing Motor Speed

Planetary adhesion drives are advantageous when an extremely quiet drive without vibration is essential. Drives of this type are incorporated in motor units built by the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. They are made in sizes up to 50 horsepower and for ratios from 4 to 1 up to 10 to 1.

This speed changer is described by the makers as the "S" type, and consists of two stationary rings, each of which has cam projections on one side, and rolls having a double taper to correspond with opposite tapers bored in the ring. One of these rings is prevented from rotating, while the other is free to rotate a very short distance. The cam sides of the rings are adjacent to each other; thus, when sufficient load is applied to the slow-speed shaft, one ring rotates a small amount and is forced away from the other ring by the action of the engaging cam projections, causing both rings to engage tightly with the double tapered rolls. The greater the load applied, the tighter the rings grip the rolls, so that no slipping can occur in the transmission of power, and similarly, when the load is reduced, the free ring moves back and thus reduces the pressure to an amount just sufficient to drive without slipping.

Changes in ratio are obtained with this type of drive by varying the diameters of these rolls. Pure rolling action is obtained, and as all the rolls operate in oil, there is very little wear. Among the equipment to which these units can be applied are separators, woodworking machines, centrifugal blowers, pumps, ore crushers, conveying machinery, and large ventilating fans.

Electro-Hydraulic Transmission

With the equipment here described should be included an electro-hydraulic transmission which has been developed by the American Engineering Co., Philadelphia, Pa., for providing rotary motion at any speed from zero to maximum. This transmission was described in October MACHINERY, page 156. Briefly, it consists of a hydraulic motor, a hydraulic pump, and an electric motor, all of these units being mounted on a bed which also serves as a reservoir for the oil used in the hydraulic system. The electric motor drives the pump shaft at a constant speed, but the speed of the hydraulic motor can be varied from zero to maximum, in either the forward or the reverse direction, by simply operating a handwheel.

X-Ray Inspection Required for Welded Boilers

By RICHARD K. AKIN, Research Metallurgist
The Robert W. Hunt Co., Chicago, Ill.

"For plate thicknesses of 3 inches and less, every portion of all longitudinal and circumferential welded joints of the structure shall be radiographed by a sufficiently powerful X-ray apparatus under a technique which will determine quantitatively the size of a defect with a thickness greater than 2 per cent of the thickness of the baseplate. The X-ray films shall be submitted to the inspector . . . Any defects repaired after the X-ray examination shall be again X-rayed."—From the A. S. M. E. Boiler Construction Code

JANUARY 1 of this year brings into effect addenda to the A.S.M.E. Boiler Code, permitting, for the first time, the use of welded boilers for the generation of steam. According to the Code, power boilers may be fabricated by means of fusion welding, provided the construction is in accordance with certain requirements for material and design and the fusion-welding process conforms to prescribed specifications.

An important requirement in connection with the manufacture of fusion-welded boilers is that for plate thicknesses up to 3 inches, every portion of all longitudinal and circumferential welded joints must be radiographed. The X-ray apparatus must be sufficiently powerful to determine quantitatively the size of a defect having a thickness greater than 2 per cent of the baseplate thickness. Boilers having a welded thickness of over 3 inches need not be X-rayed, but the manufacturer must demonstrate his ability to produce sound welds in boilers made of plate not less than 2 1/2 inches thick.

The X-ray films of boiler welds must be submitted to the inspector, together with the following information: (1) Thickness of plate; (2) distance of film from rear of joint; (3) distance of film from source of X-rays; (4) voltage impressed on tube; (5) current flowing through tube; (6) time of exposure; (7) type of film used; (8) type of intensifying screens.

Somewhat similar rules have been adopted by the A. S. M. E. to cover unfired pressure vessels. Defects repaired after X-ray examinations on either boilers or unfired pressure vessels must be X-rayed again before they can be approved by the inspector. The Robert W. Hunt Co., Chicago, Ill., has prepared for the inspection of boilers and pressure vessels, as required under the regulations of the Boiler Code, by establishing an X-ray laboratory intended to serve manufacturers throughout the Middle West. Boiler drums and other parts can be shipped direct to this laboratory by freight cars or trucks.

To determine whether or not an X-ray film shows defects of a thickness as low as 2 per cent of the baseplate, the Boiler Code recommends that a piece of sheet steel having a thickness of 2 per cent of the baseplate and containing a small hole should be placed beside the welded joint being radiographed, so that it will appear on the X-ray film. If the image of the hole in the sheet-steel piece appears on the X-ray film, it is evident that "2 per cent" defects are visible.

Feeler gages are used at the Hunt Laboratory for this purpose, as will be seen in the upper X-ray film shown in Fig. 1. Black spots of far greater intensity than the hole in the feeler gage appear in the welded metal, indicating that the weld would not pass inspection.

One of the great advantages of X-ray pictures is that they lead to improved welding technique. Metallurgists can study the X-ray pictures and change welding methods with a view to improving them; then, after the change, X-ray pictures can be taken again, and the results noted. Fig. 2 shows, at the top, the kind of weld one manu-

Fig. 1. X-ray Film in which a Feeler Gage Indicates Weld Defects Greater than 2 Per Cent of the Baseplate Thickness

facturer obtained at first on steel plate. The film shows the weld to be full of slag and gas pockets.

After studying the welding methods by means of the X-ray pictures, the welding technique was so improved that the same welders produced work of the high grade shown at the bottom in the same illustration. This weld is almost perfect.

X-Ray Studies Eliminate Hazards in Airplane Flying

There is another field in which welds are used extensively and in which defective welds are a danger to human life—the airplane industry. Here welds are used for fastening various struts and other members of the fuselage, ailerons, rudders, fins, etc. Hence, in airplane construction, dangers may lurk in every welded joint.

Fig. 2. X-ray Pictures that Illustrate an Improvement Made in Welding Technique as a Result of X-ray Studies

X-rays enable studies to be made of the welding practice in airplane plants, so as to insure the use of the best possible methods. Sometimes the weld itself may be all right, but the welding process may have caused other defects. Fig. 3 shows a welded joint on an airplane member. In this case, the weld itself is good, but in the welding operation, the parent metal was burned. This, of course, weakens the part.

* * *

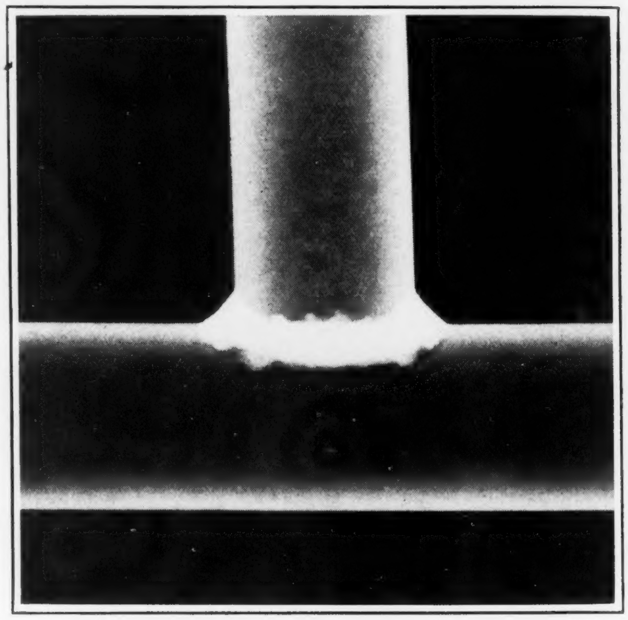
A fixed price policy is the only fair method of doing business. To sell to one customer at one price and to another at a lower figure is equally unfair to competitors and to customers. This practice has been the cause of more difficulties in business than almost anything else.

A Gloomy Business Forecast

This is a gloomy business forecast, but do not read the last sentence first. It might disperse the blues.

In a recent address, Professor William T. Foster quoted a group of leading financial statisticians—experts in business forecasting—who met in New York City on November 4. Professor Foster quoted from the eight experts as follows: "The farmers will not buy much from the proceeds of this harvest; and, with the price declines in process throughout the world, there would seem to be little prospect of any extensive business revival in the near future." . . . "The general prospect is for slow and irregular business for ten years." . . . "I expect to see a long and slow recovery to a general level of subnormal, slow business." . . . "Prices will advance a little from present levels and then fall once more. Recovery will be slow." . . . "Conditions abroad will continue to affect our business conditions here. It is a conservative estimate to say that ten years must elapse before we can see genuinely prosperous business in this country." . . . "Business will come back to fair, slow operations in three years." . . . "The period of readjustment will be long. It will take at least ten years." . . . "We may expect a slow return to a basis on which business can be done at a profit in about three years."

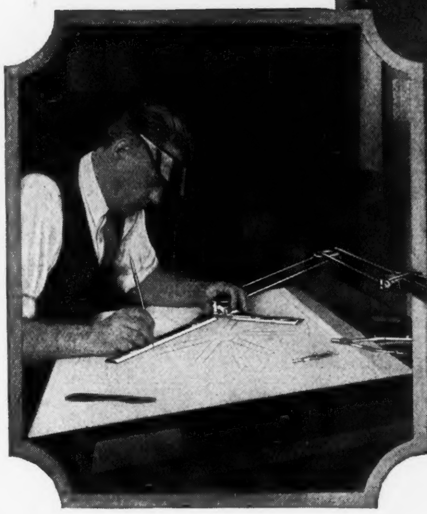
Fig. 3. Welded Joint of an Airplane Member in which the Parent Metal was Burned in the Welding Operation



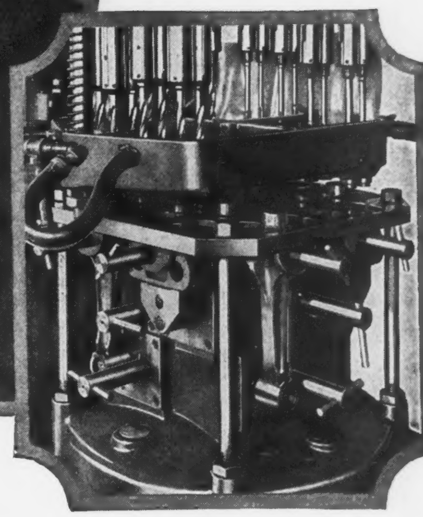
These pessimistic forecasts were all made on November 4, 1921. No further comments required!

* * *

The boss who cannot correct a subordinate without losing his temper is unfitted for his job.—*The Shop Review*



Design of Tools and Fixtures

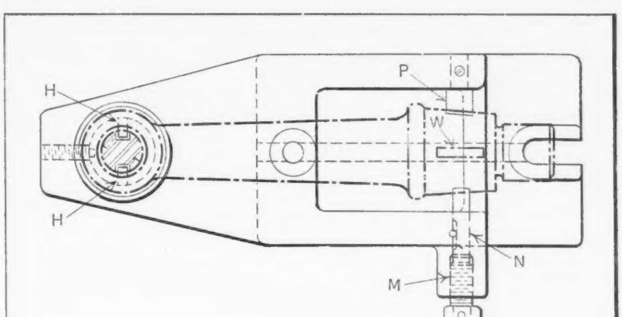


Milling Keyway in Tapered Offset Arm

By F. H. MAYOH, Springfield, Mass.

An ingeniously designed fixture for holding a part while milling a keyway in a tapered offset arm is shown in the accompanying illustration. The part, which is shown by dot-and-dash lines at *X*, has a tapered hole at *Y*, and is also tapered at *Z*. The object of the fixture is to hold the work securely while the keyway *W* is being milled.

On the body *A* of the fixture is a machined locating tongue *B* which engages the groove in the milling machine table. At *E* is a hardened steel bushing, which is held securely in the fixture by the threaded nut *F*, and prevented from turning by the screw *G*. In this bushing are two pins *H* that enter two slots *K* milled in the tapered plug *J*. These slots are of the bayonet lock type and are designed to exert a downward clamping action on plug *J* when the plug is turned to the right by means of the cross-pin seen at *L*.



Fixture Used in Milling Keyway in Offset Arm

The work is put on the fixture in the position shown, and plug *J* is passed through the tapered hole in the work with its straight end in bushing *E*. The operator then turns the plug, thereby wedging it into the tapered hole in the work. At the right-hand end of the fixture a screw *M* with a hand-knob is tightened against the non-revolvable pin *N*, which forces the work against the stationary pin *P*, thus holding that end of the work with sufficient rigidity to permit the keyslot *W* to be milled. Pins *P* and *N* are machined on their ends to fit the tapered surface of the work.

Scraper for Finishing Brass Spheres

By DANIEL GERRILD, Chicago, Ill.

The scraper shown in the illustration has been used successfully for several years in making brass and bronze balls with diameters ranging from 1 to 3 inches. Scrapers of the same design can also be used for smaller or larger balls. The balls finished with the scraper shown are used for the check valves of milk pumps and must form a perfect seal when placed on a seat 1/16 inch wide.

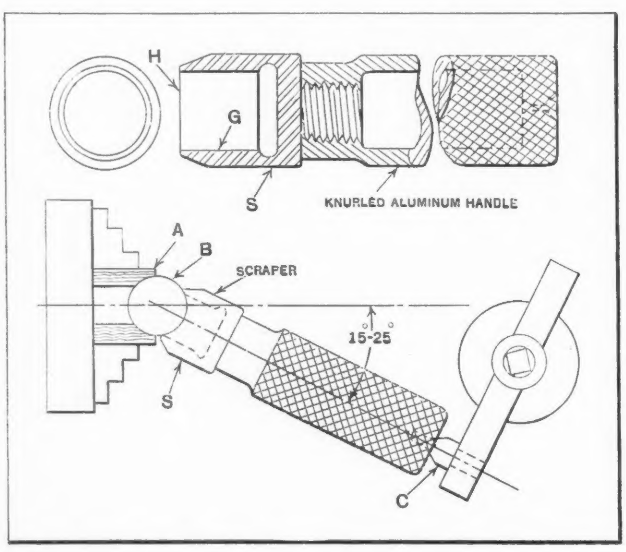
The cast brass ball is gripped in a universal chuck and a roughing cut is taken over one-half of the surface, using a blunt-nosed tool and hand feeds. The ball is then reversed and the other half machined. Two more cuts are taken with the work turned so that the second cuts are taken at about 90 degrees to the first. This leaves the ball roughly machined over its entire

surface. If a large number of balls are required, it will probably be best to employ a special forming tool for this roughing operation.

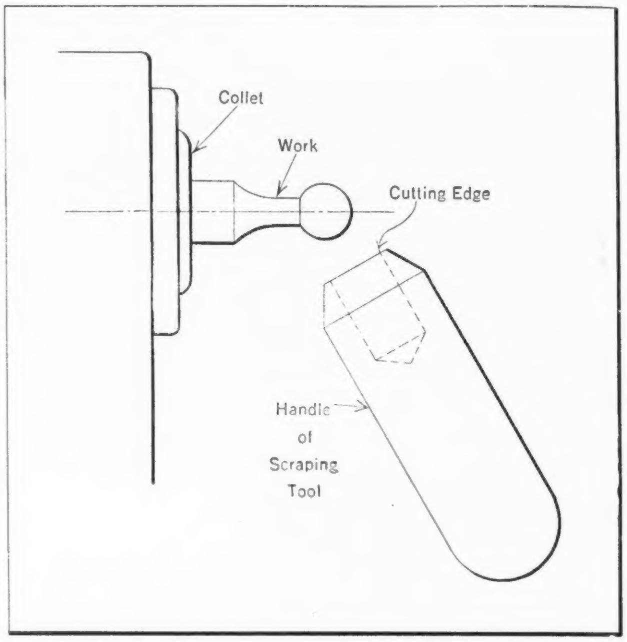
The piece of wood A is next chucked in the lathe and bored out to receive the ball B, leaving a seat 1/4 to 1/2 inch wide and deep enough to allow the ball to enter to within, say, 1/16 to 1/8 inch of its center. The scraper is then applied to the ball by placing it between the ball and the center C, which is held in the lathe toolpost, the scraper being set at an angle of from 15 to 25 degrees with the center line of the lathe spindle. The knurled part of the tool is gripped by the hand to prevent it from rotating with the ball. This is continued until the section covered by the scraper is shaved smooth.

The ball is now turned to another position and the operation repeated until the entire surface has been scraped and all tool marks have disappeared. The slowest speed obtainable without using the back-gears is employed. When the ball is fairly smooth, the carriage is run aside and the scraper applied by hand. Uneven parts of the surface are easily discovered by noting the cutting action of the scraper. When the work has been given a true spherical surface, the scraper will produce an even shaving of uniform thickness. The position of the ball can be easily changed when the scraper is held by hand. This permits the entire surface to be gone over quickly.

The scraper S is made of tool steel and hardened. It is ground on the inside at G and at the end H, after which these surfaces are honed carefully to remove marks left by the grinding wheel. The bore G of the scraper should be about 3/32 to 1/4 inch smaller than the finished ball. The balls produced as described are within 0.0001 inch of being spherical and have a smooth, glossy finish. While the scraping tool may not be suited for mass production, it provides a practical and simple method of handling small lots. It may also be used for forming accurate spherical shapes on brass and bronze work held between lathe centers.



Scraper Used for Finishing a Brass Ball



Simple Tool for Finishing Ball to Size

Tool for Turning a Ball to Exact Size

By F. E. FICK, Lakewood, Ohio

Drawings for pieces with ball-shaped ends like the one shown in the illustration were recently sent into the shop. Being curious to know how the ball-shaped end would be turned to the exact size required, the writer followed up the job.

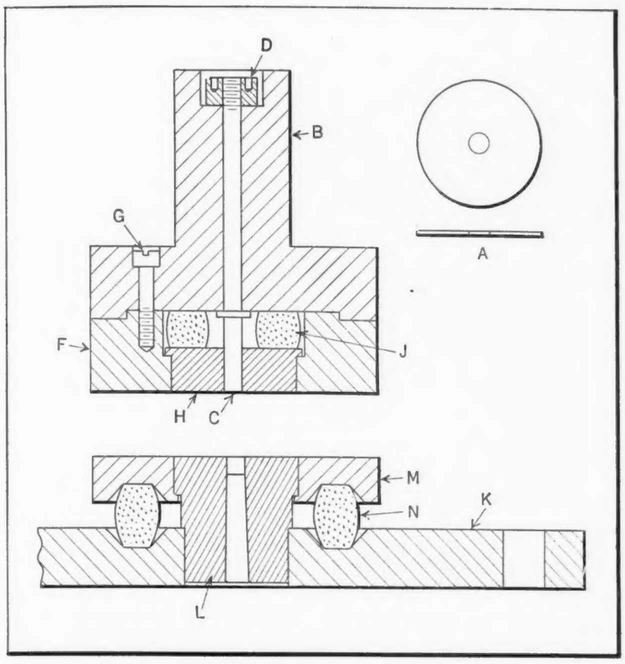
The mechanic to whom the job was given proceeded to rough out the ball in a lathe to approximately the size required, using a forming tool to get it down nearly to the proper size and contour. He then made a finish-sizing tool, as shown in the illustration, by reaming a hole the size of the ball in the end of a piece of tool steel. This tool was hardened and the edges of the hole sharpened so that they would act as a scraper. The tool thus produced was pushed by hand against the revolving ball until it had scraped off the surface metal and slipped over the ball.

This procedure gave a nearly perfect ball of the size required in a remarkably short time and without any bothersome measuring. When the workman was complimented on the manner in which he had handled the job, he said that the shop where he had previously worked often had jobs of this kind and that they kept available several scrapers of the kind described for finishing balls of different sizes.

Combination Die for Producing Washer

By S. A. McDONALD, Brooklyn, N. Y.

The combination die here illustrated, for producing the washer shown at A, was built by a machinist in two days' time. The punch-holder B contains the piercing punch C with its retaining nut D. The holder B is recessed to receive the



Die Used in Producing Washer A

blanking ring *F*, which is held in place by three screws *G*. The stripper *H* is backed up by the rubber pad *J*. The lower half of the tool consists of the bolster *K* into which is driven the blanking punch and piercing die *L*. The stripper ring *M* around the piercing die *L* is held up against the shoulder by the rubber ring *N*.

When the press ram descends, the blanking ring *F* forces the stock and the lower stripper ring *M* down, blanking the washer and at the same time causing the punch *C* to pierce the hole. The disk formed by the punch *C* passes down through the die. During the ascent of the ram, the finished washer is stripped from the punch *C* by the stripper *H*. As the punch is inclined, the washer falls down through a chute and into a box.

Bar for Boring Long Recesses in Small Bores

Recesses of practically unlimited length can be bored by means of a bar like that shown at *B* and *C* in the illustration. This bar was designed for cutting a recess 7/8 inch in diameter by 12 7/8 inches deep in the steel tube indicated at *A*.

The tube is machined from bar stock in a turret lathe. First, the outside of the bar is turned, and a 5/8-inch hole is bored to a depth slightly greater than the length of the finished tube. The tube is then cut off, and in another operation, both ends of the 5/8-inch bore are enlarged to 0.742 inch for a depth of 2 1/8 inches, thus allowing 0.008 inch for grinding.

The tube is now ready to be recessed. As indicated at *B*, the swivel end of the tool is inserted in the enlarged end of the bore, the lathe spindle being stationary until the conical end of the swivel comes into contact with the end of the 5/8-inch bore. The spindle is then rotated, and the recessing tool carried forward by hand feed until the cutter has entered to its full depth, at which time a fine power feed is employed to complete the boring of the recess. It will be noted that the swivel, which is a slip fit in the 5/8-inch bore, serves as a pilot to support the cutter in its boring position.

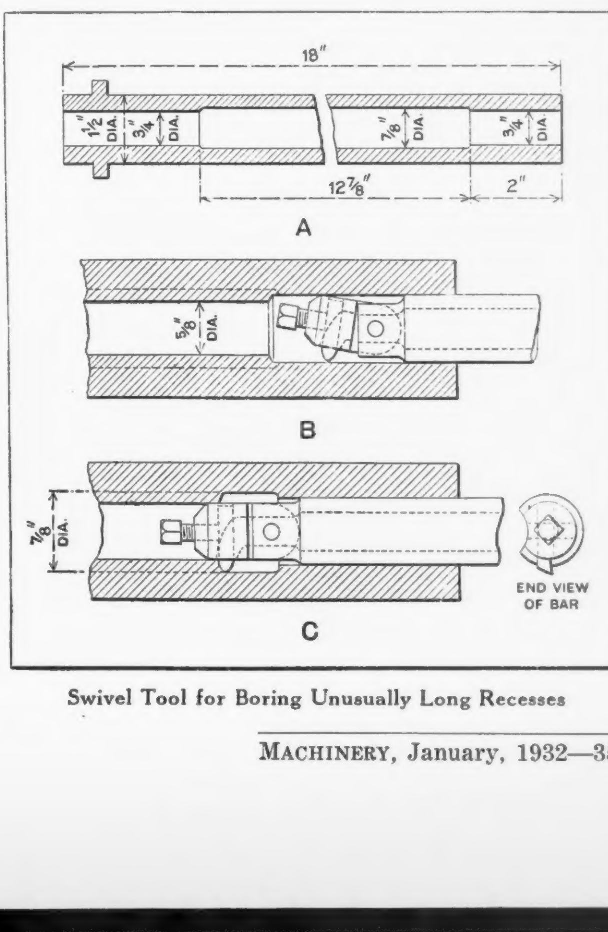
The cutting tool must be ground with little rake, so that the chips will break up instead of curling. It is also advisable to withdraw the bar frequently, stopping the spindle meanwhile, in order to clear away the chips.

Obviously with this type of boring-bar, when the tool wears, the under-size bore cannot be enlarged by taking a second cut, as with other types of bars; hence it is necessary to check the setting of the cutter frequently. The cutter can be easily reset in the bar or checked by means of a regular 3/4-inch ring gage. J. B.

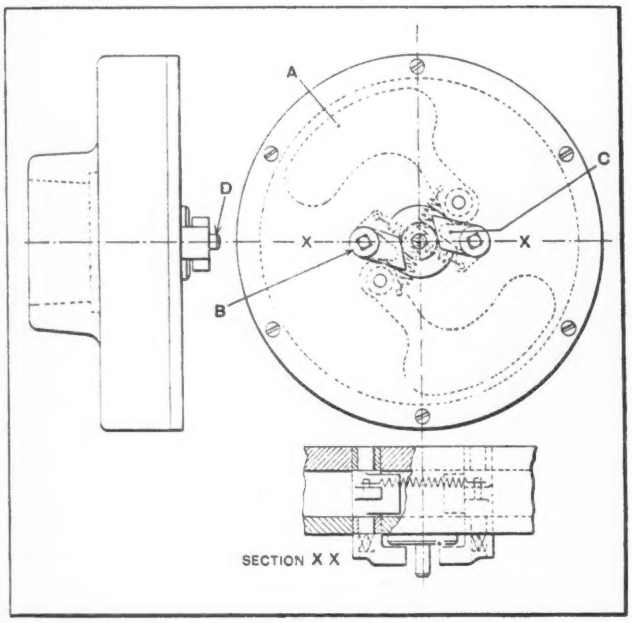
A Centrifugal Lathe Chuck

A centrifugal chuck with jaws that open and close automatically for loading and removing the work is shown in the accompanying illustration. The chuck jaws are actuated by cams operated by weights, which, due to centrifugal force, swing outward when the chuck rotates. With the spindle stationary, however, the weights and jaws are held in their open or loading position by coil springs.

The work gripped in this chuck is small, and has a 3/16-inch blind hole in one end which serves to locate the work on the centering plug *D*. In operation, the centrifugal force resulting from the rotary movement of the lathe spindle causes the weights *A* to swing outward, which, in turn, causes the cam ends of the weights to come in contact with



Swivel Tool for Boring Unusually Long Recesses



Centrifugal Chuck for Holding Small Parts in a Bench Lathe

the cams C, thus tightening the jaws B. Stopping or reversing the spindle allows the weights to swing in again and release the work. W. G.

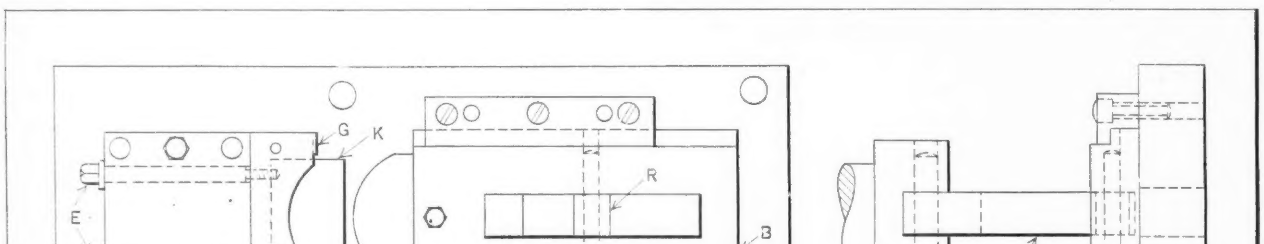
Auxiliary Bending Punch with Hopper Feed

By H. R. SCHMIDT, Philadelphia, Pa.

Flat, embossed nameplates, received in orderly stacked packages of seventy-two plates, were required to be bent to the curved form shown at D in the illustration. At first these pieces were fed by hand, one at a time, into a bending die, the finished piece being pushed out of the die with a wooden stick.

To speed up this work, a dial feeding plate was made up with a series of nests in it of the same shape as the nameplates. The operator, located at the front of the machine, placed the pieces in the nests in the dial as they came opposite him. Each piece was carried around into the die and bent up, after which it was automatically pushed back into the dial, carried away from the die, and allowed to fall into a box under the press. Although this was faster than the older method, it did not give the desired production, as it was necessary to run the press at a slow speed.

An auxiliary bending punch with a hopper feed, as shown in the accompanying illustration, was next tried out and found entirely satisfactory. The punch slide B moves in a horizontal direction instead of vertically. The plate P, attached to the



Hopper-fed Auxiliary Punch for Bending Nameplates to Curved Shape

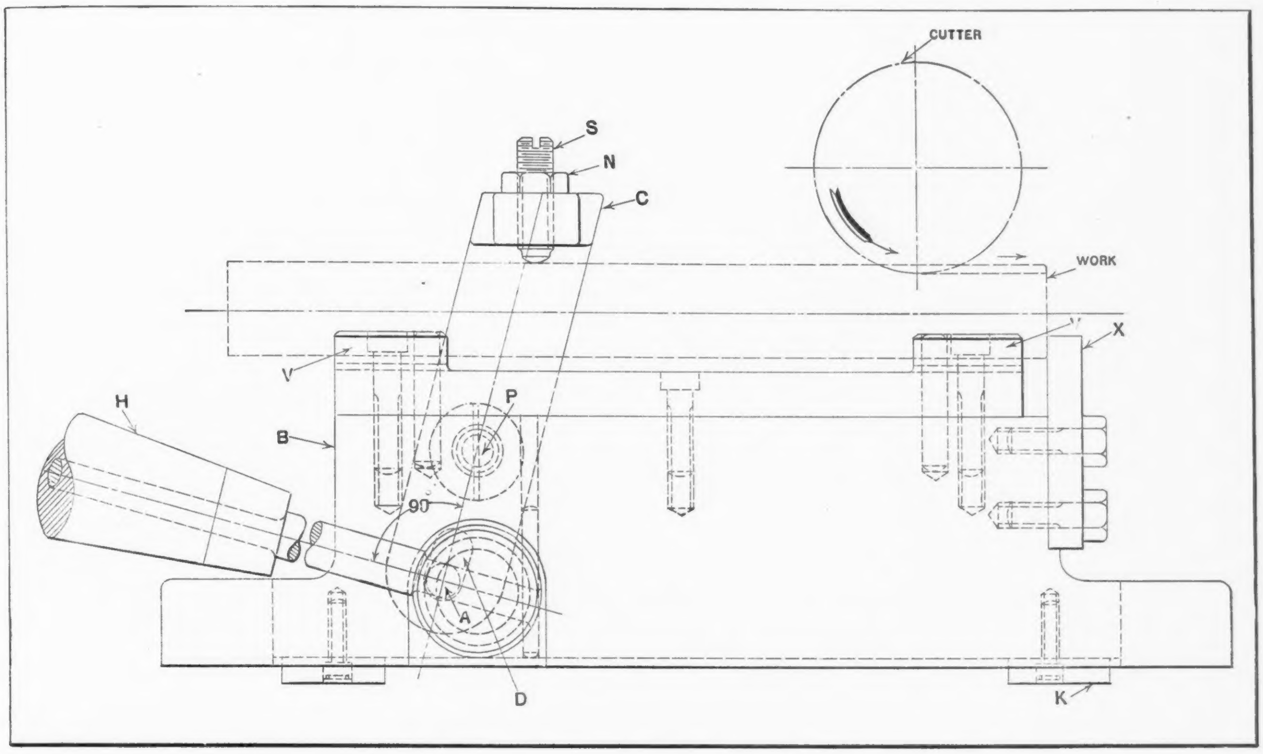


Fig. 1. Quick-acting Fixture Used on Hand Miller

press ram, has a cam slot *S* in it which imparts the horizontal movement to the bending punch.

Referring to the illustration, the base *A* and slide *B* are of cast iron. Slide *B* is drilled at one end to receive the shank of the bending punch. It is also slotted and fitted with a roll *R*. The block *C* is of steel, and is securely fastened to the base *A*. The bending die is fastened to block *C* by the screws *E*. The cam slot *S* in the tool-steel plate which engages the roller *R* is cut at an angle of 45 degrees.

On starting the press, slide *B* is given a horizontal motion equivalent to the stroke of the press. It can also be adjusted to deliver either heavier or lighter blows by raising or lowering the ram. Directly over the die and attached to it is the magazine *H* from which the nameplates are fed. The plates come to rest against stops *G*. On being bent, the nameplates become shorter, pull away from the stops *G*, and fall out of the die into a box under the press when the punch recedes.

In operating the press, the flat nameplates are removed from the package and put into the hopper *I*. The operator then presses them forward with the thumb of one hand while he works the feeding slide *J* up and down with the other hand, pushing a nameplate into the magazine at each downward stroke, the press being run continuously. With this arrangement, the operator is able to feed the nameplates to the bending die faster than they can be handled by the press. Thus the only lost time is that spent in removing the wrappers from the new stacks of plates and placing the plates in the hopper. It is estimated that this method of bending the plates is about six times as fast as the one originally employed.

Quick-Clamping Keyway-Milling Fixture

By ERNEST NIEDERER, Berwyn, Ill.

The fixture shown in Fig. 1 was designed for use on a hand miller employed in milling small keyways in gear shafts. The principal feature of this fixture is the quick-acting clamp which releases the

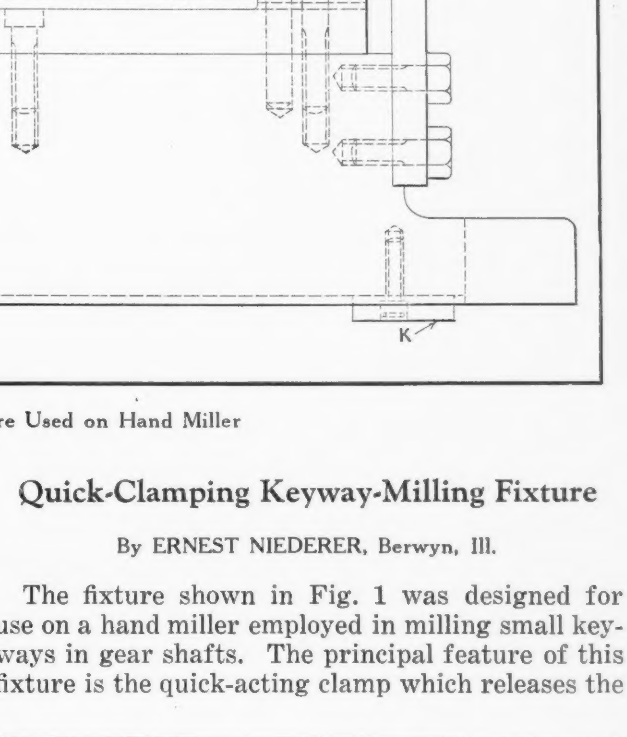
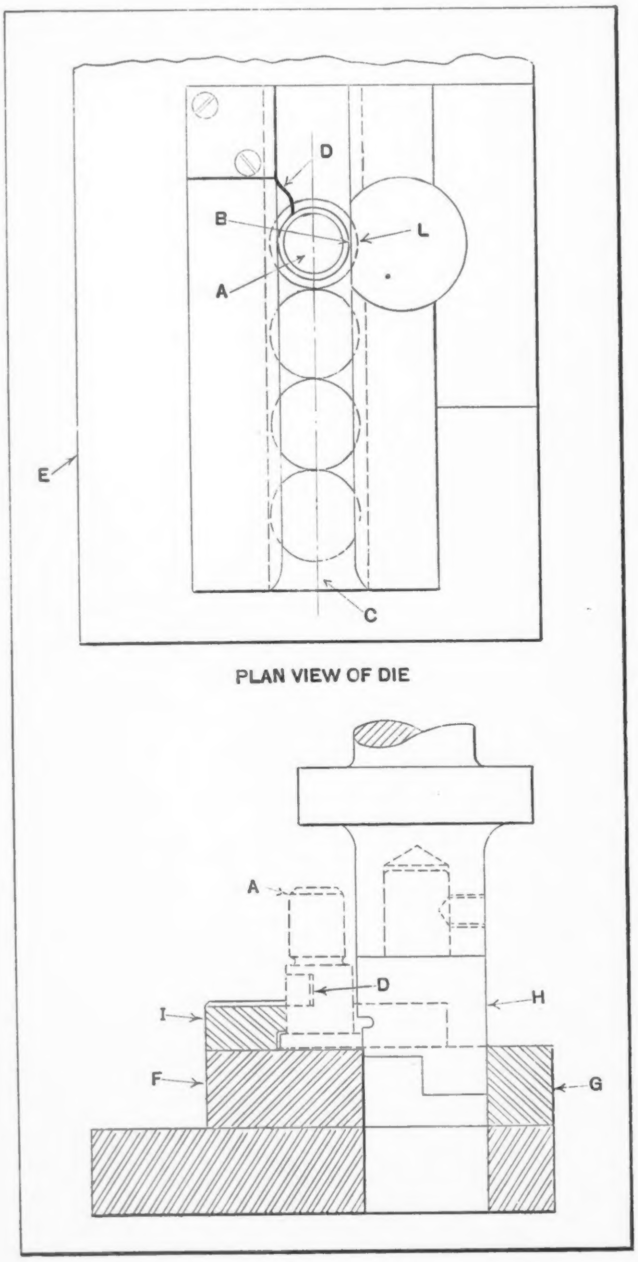


Fig. 2. Cross-section on Center Line of Part C, Fig. 1.

work instantly when the handle *H* is raised. By simply lowering the handle, a new piece is clamped in place, the weight of the handle, acting through the clamping mechanism, being sufficient to clamp the work securely against the V-blocks *V* and the stop *X* which takes the thrust of the milling cutter. The clamping lever *C*, Figs. 1 and 2, pivots on pin *P*, and is operated by the eccentric pin *A* in the slot *D*. Pin *A* is machined integral with the body *F*, to which the operating handle *H* is attached.

The screw *S* can be adjusted on lever *C* to give the maximum clamping pressure on pieces of various diameters. Lock-nut *N* serves to secure the screw *S* in place when it has been properly adjusted. The maximum clamping pressure is obtained when the included angle formed by the center line of lever *C* and the center line of handle *H* is 90 degrees, as shown in Fig. 1.



Hand-fed Die which Cuts a Flat on Stud Heads at the Rate of Ten per Minute

Die for Cutting Flat on Stud Head

By W. E. GUNNERSON, Rockford, Ill.

The automobile stud shown at *A* in the illustration is required to have a flat surface or spot on the head at *B*. This flat serves as a stop to keep the stud from turning when assembling. The flat is produced by the punch *H*, which shears off the portion shown at *L*. After the first four pieces have been loaded into the die at *C*, each succeeding piece forces the completed part past spring *D*, which also serves as a stop. Thus the hazard of placing the work directly under the ram is eliminated.

The die consists of the die-block *E*, the hardened block *F*, which serves as a cutting edge, the punch *H*, and the backing block *G* for the punch which has a heel that enters the die ahead of the cutting edge. The part *I* serves both as a stripper and a guide. The press is inclined at an angle, so that the finished pieces readily clear the die. The production is ten pieces per minute.

* * *

A Novel Automatic Oiling System

A novel automatic oiling system for industrial machinery and automobile chassis has been developed by the Motor and Plane Accessories, Inc., Detroit, Mich. This device operates electrically without a pump or other moving parts. It consists of an oil tank made by the Westinghouse Electric & Mfg. Co., equipped with a heater unit which is separated from direct contact with the oil. When the machine that is to be lubricated is started, the electric heater unit inside the tank is automatically turned on.

The temperature of the oil is raised, which causes expansion and forces the oil out of the tank to the bearings, where proper metering devices control the flow of oil. After the temperature has reached 150 degrees, a thermostat breaks contact and allows the oil to cool to 100 degrees. At that temperature the thermostatic switch again makes contact.

During the cooling process a vacuum occurs which is utilized to refill the tank from a central supply or reservoir. A check-valve in the main feed line prevents drawing oil back from the bearings. To maintain the pressure on the main line while the tank is refilling, an ingenious auxiliary feeder is installed, which continues to hold the pressure while the tank is being replenished. Therefore there is no time during the operation in which there is a lack of pressure in the feed line.

* * *

Age-worn economic ideas hold us so firmly in their grip that our economic methods are out of gear with our engineering progress. Of what value is labor-saving machinery if men and machines are idle half of the time? It is worth while saving labor only when labor benefits by the saving.

PROPERTIES OF WROUGHT-ALUMINUM ALLOYS*—1

Alloy Symbol	Properties of Alloys: Weight per Cubic Foot, Pounds	Ultimate Tensile Strength, Pounds per Square Inch	Yield Point, Pounds per Square Inch	Elongation, Per Cent in Two Inches	Brinell Hardness, 500 kg. Load—10 mm. Ball	Composition of Alloys, Per Cent: Copper	Manganese	Magnesium	Silicon	Aluminum
2S	171	......	......	.....	.....	...	....	...	...	99.0
2S1/2H	171	17,000	14,000	20	32	...	....	...	...	99.0
2SO	171	13,000	4,000	40	21	...	....	...	...	99.0
2SH	171	24,000	21,000	10	38	...	....	...	...	99.0
3S	171	......	......	.....	.....	...	1.25	...	...	98.75
3S1/2H	171	21,000	17,500	20	45	...	1.25	...	...	98.75
3SO	171	16,000	5,000	40	28	...	1.25	...	...	98.75
3SH	171	29,000	25,500	10	55	...	1.25	...	...	98.75
4SO	172	26,000	10,000	20	45	...	1.25	1.0	...	97.75
4S1/4H	172	32,000	29,000	5	62	...	1.25	1.0	...	97.75
4S1/2H	172	35,000	32,000	5	68	...	1.25	1.0	...	97.75
4S3/4H	172	38,000	36,000	4	75	...	1.25	1.0	...	97.75
4SH	172	43,000	41,000	3	85	...	1.25	1.0	...	97.75
43SO	172	17,000	6,500	28	28	...	1.25	1.0	...	97.75
43S1/4H	172	21,000	19,200	10	39	...	1.25	1.0	...	97.75
43S1/2H	172	24,000	21,500	7	44	...	1.25	1.0	...	97.75
43S3/4H	172	27,000	22,500	5	47	...	1.25	1.0	...	97.75
43SH	172	30,000	27,000	4	50	...	1.25	1.0	...	97.75
17S	...	......	......	.....	.....	4.0	0.5	0.5	...	95.0
17ST	174	58,000	35,000	18–25	90–105	4.0	0.5	0.5	...	95.0
17SO	174	26,000	10,000	14–22	45–55	4.0	0.5	0.5	...	95.0
17SRT	174	63,000	46,000	13	.....	4.0	0.5	0.5	...	95.0
A17S	174	......	......	.....	.....	2.5	....	0.3	...	97.2
A17ST	174	40,000	22,000	20–28	55–75	2.5	....	0.3	...	97.2
A17SO	174	22,000	8,000	20–28	30–40	2.5	....	0.3	...	97.2
B17S	...	......	......	.....	.....	3.5	....	0.3	...	96.2
B17ST	174	48,000	25,000	20–28	65–85	3.5	....	0.3	...	96.2
B17SO	174	22,000	8,000	20–28	30–40	3.5	....	0.3	...	96.2
C17S	174	......	......	.....	.....	4.0	0.5	0.5	1.2	93.8
C17ST	174	65,000	50,000	8–14	95–125	4.0	0.5	0.5	1.2	93.8
C17SW	174	58,000	35,000	18–25	90–105	4.0	0.5	0.5	1.2	93.8
C17SO	174	28,000	12,000	12–20	42–55	4.0	0.5	0.5	1.2	93.8
25S	...	......	......	.....	.....	4.5	0.8	...	0.8	93.9
25ST	174	58,000	35,000	16–25	90–105	4.5	0.8	...	0.8	93.9
25SW	174	48,000	25,000	15–22	68–85	4.5	0.8	...	0.8	93.9
25SO	174	26,000	10,000	12–20	45–55	4.5	0.8	...	0.8	93.9
51S	168	......	......	.....	.....	...	....	0.6	1.0	98.4
51ST	168	48,000	35,000	10–18	90–100	...	....	0.6	1.0	98.4
51SW	168	35,000	20,000	20–30	55–70	...	....	0.6	1.0	98.4
51SO	168	16,000	5,500	22–32	25–32	...	....	0.6	1.0	98.4

*Compiled by the High Pressure Tank Car Department of the General American Tank Car Corporation

MACHINERY'S Data Sheet No. 217, New Series, January, 1932

PROPERTIES OF WROUGHT-ALUMINUM ALLOYS*—2

1. The symbol 2S in Data Sheet No. 217 is the designation for wrought aluminum that is 99 per cent pure or better. Therefore, this is not really an alloy. Cold-working produces the several tempers.

2. Strong alloys of aluminum, designated by the symbols 17S, 25S, and 51S, are primarily wrought materials that have been worked sufficiently to obliterate the cast structure of the alloys, and have been subsequently heat-treated.

3. The 3S alloy is not a strong alloy, but attains different tempers by different amounts of cold-working. Symbol "H" designates a hard wrought temper, and "1/2H" a half-hard temper.

4. The letter "O" indicates a soft temper brought about by suitable annealing after having been strain-hardened by cold-working. This temper is often referred to as "dead soft." To obtain this soft temper in alloys 17S, 25S, and 51S, they should be held at a temperature of 800 degrees F. for one hour and then cooled slowly to below 500 degrees F.

5. The symbol "W" is the "as quenched" temper. The alloy is heated to a temperature as high as possible without encountering danger of melting any of the constituents, in order to increase the rate of solution and diffusion of the hardening material. It is then quenched so as to retain, at ordinary temperatures, the conditions existing in the metal at the higher temperatures, as far as possible.

For the 17S alloy, aging takes place immediately, and it cannot be kept in the "W" condition. The alloys 17S, A17S, and B17S are heated to temperatures as high as 940 to 960 degrees F.; C17 to 920 to 940 degrees F.; and 25S and 51S to 960 to 980 degrees F. As a result of this operation, the alloying constituents are quite uniformly distributed throughout the metal in solid solution, and the whole operation is known as "solution heat-treatment."

6. The letter "T" designates the "heat-treated" temper, and is used to represent the alloy in the temper possessing the maximum strength and hardness that are produced by heat-treatment processes. The alloy has been subjected not only to "solution heat-treatment," but also to "precipitation heat-treatment," which means that the alloys have been aged at an elevated temperature after they have been quenched, and the time varies with the nature of the material and the size, from eight to fifteen hours. For the alloy 25S, the aging range is 285 to 295 degrees F., and for 51S and C17S, the range is 310 to 320 degrees F., for a period of eighteen hours. If aging is continued for too long a time and at too high a temperature, a lower elongation and lower tensile strength will result.

The alloys 25ST, 51ST, and C17ST require both solution heat-treatment and precipitation heat-treatment, whereas alloys 17ST, A17ST, and B17ST require only solution heat-treatment followed by aging at normal room temperatures. Alloys 17ST, A17ST, and B17ST attain maximum properties in about four days. All alloys can be machined most readily when heat-treated to the "T" temper.

7. The mechanical properties of the alloys 17ST and 25ST are substantially identical.

8. The tensile strength of alloy 51ST is lower than that of 17ST or 25ST, but the yield point may be the same or even slightly higher; therefore alloy 51ST is well suited for products that require little forming.

9. In hot-forming 17S plate, the metal is heated to a suitable temperature and takes a chill in the dies that constitutes a quench. Aging, then, at ordinary temperatures gives resulting sections having maximum mechanical properties without the necessity of further heat-treatment. In using the 25S or 51S alloys in such forming operations, precipitation heat-treatment must follow if it is desired to have maximum mechanical properties.

*Compiled by the High Pressure Tank Car Department of the General American Tank Car Corporation

MACHINERY'S Data Sheet No. 218, New Series, January, 1932

Selecting the Right Lubricant

Too Often the Price per Gallon is the Deciding Factor in the Choice of a Lubricant

By G. L. SUMNER, Oil Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

THE selection and stocking of suitable lubricants is an important problem in the large industrial plant, owing to the diversified types of machinery employed and the widely divergent lubricant recommendations made by the manufacturers of these machines. No two plants will have exactly the same conditions and, therefore, requirements must be considered individually, if low maintenance costs are to be secured.

Good lubricants are essential to low maintenance costs. Too often the price per gallon enters into the choice of a lubricant for a given application. Sometimes the higher priced oils are cheaper in the long run, because power loss, excessive wear, interrupted service, repairs, and even the ruin of expensive machinery may result from the use of unwisely chosen, low-priced lubricants. In one instance, a difference of a few cents a gallon on a tank car of lubricating oil, cost several thousand dollars in damage to equipment, to say nothing of interrupted production and the trouble involved in removing the oil of poor quality and replacing it with other oil. Such cases are rare in a plant where adequate inspection facilities are available, but it illustrates what can, and sometimes does, happen.

On What Basis Should Oils be Selected?

In selecting a lubricant, it is desirable to choose an oil wherever practicable, since it is the oil that provides a film for bearings to ride upon, even when a grease is employed. The choice of an oil for a given application depends largely on its "body" at the required operating temperature. In general plant practice, this can best be determined in the machine in which the oil is to be used, although the numerous friction machines on the market show the viscosity of oil, and in some cases, yield other useful data.

In a laboratory, these machines are of some assistance in predicting what an oil will do in service, but in view of the many other factors that determine the suitability of an oil, an operating test should be the final criterion. In the absence of a regular lubrication laboratory, and under the usual plant conditions, viscosity as determined by the universal viscosimeter, plus operating experience, serves best to determine the oil to be used for a given application.

In choosing an oil for a definite application, it should be determined first just what the oil has to do to provide proper lubrication. The size of the bearings, pressure and speed of the shaft, and the clearance are important. Bearings subject to high speeds and a low pressure require fairly light oil.

There are engineers who even go so far as to claim that in some high-speed machines, after a certain speed is reached, very little, if any, oil is required, because the bearings ride on a cushion of air.

Slow speeds and high pressures require sufficient body in the lubricant to prevent metal-to-metal contact in starting. At the same time, the lubricant should not be so viscous that undue loss of power will result from the internal friction of the lubricant itself. On the other hand, too light an oil will not keep the metal surfaces apart and undue wear will result.

In order to facilitate starting machines subjected to cold weather, the oil should have a low pour-test. It is possible to expose bearings to as much wear during the first few minutes of a warming-up period, as they would get in weeks under normal operating conditions. As the oil becomes warmer, the viscosity becomes lower and, in a measure, adjusts itself, assuming, of course, that it has been chosen to provide the correct body at normal operating temperatures.

In this connection, attention may be called to the fact that a reduction in bearing temperatures may be obtained through the use of an oil that has the right viscosity at operating temperatures. Oil salesmen often apply this fact on trouble jobs, by making a viscosity test of the oil being used in the machine that is "running hot." This oil is then removed, the bearings thoroughly cleaned, and new oil is introduced that provides a more suitable film at operating temperatures. The bearings immediately begin to run cooler.

The Question of Naphthene- or Paraffin-Base Oils

In trying to determine the proper viscosity at operating temperatures, it should be remembered that the so-called naphthene-base oils (coastal crude oils) require a higher viscosity to provide the same film as an oil of paraffin base. This difference becomes smaller as the temperature rises up to a certain point. Generally speaking, naphthene-base oils have a greater change in viscosity with a change in temperature than oils refined from paraffin-base crude oils. Also, in a straight-run oil produced from any given crude oil, there is a direct relation between the flash point and the viscosity. While, in general, the heavier oils have higher viscosities and flash points, this is not a simple relationship, and in the case of blended oils, the specific gravity has no direct relation to either the viscosity or flash point.

The question is often asked as to whether naphthene- or paraffin-base oils are the better lubricants.

This is a much-mooted question and depends upon the application. The so-called naphthene and paraffin crude oils are, in all cases, mixtures; that is, the naphthene oils contain paraffin hydrocarbons and the paraffin oils contain naphthene hydrocarbons, so that these hydrocarbons are intermingled in the crude oils of both kinds. The ratio of these hydrocarbons determines the nomenclature. Paraffin oils seem to provide a more firmly adhering film, but they are also more subject to carbonization. The naphthene oils resist heat fairly well and have greater fluidity at reduced temperatures. Therefore, in selecting an oil, say for use in combustion engines, a blend that minimizes the defects in each kind may be desirable.

Mineral Oils Blended with Animal or Vegetable Oils

Most oils offered for industrial lubrication are straight refined petroleum products. However, in some instances, it is desirable to blend mineral oils with animal or vegetable oils. Cylinder oils, for instance, are often compounded with from 4 to 6 per cent of acidless tallow to make them adhere to metal surfaces.

While there has always been a tendency to add small amounts of oleic acid to mineral oil as a means of increasing its oiliness, or its adherence to metal surfaces, this has generally been considered bad practice in the past, due to the belief that the fatty oil would become rancid in service and corrode the bearings. Recent indications are that there is not so much cause for alarm as was once supposed, and some interesting results have been obtained in the way of reduced coefficient of friction through compounding the oils.

Lubricating Oils with Saybolt Universal Viscosity Readings from 145 to 3500 Seconds at 100 Degrees F.

Grade	Approximate Viscosity	Application
Turbo Oil	145–150	Turbo-Generator Bearings
Light Machine Oil	180–210	General Purposes
Internal Combustion Engine Oil	260	Farm Lighting Equipment
Compressor Oil	275	Air Compressors
Pump Oil	300–375	Vacuum Pumps
Motor Oil, Light, Medium and Heavy	200, 450, 1050	Automotive
Car Oil, Summer and Winter	1200, 300	Railway Bearings
Crankcase Oil	625	Steam Engine Crankcase
Diesel Oil	600–900	Oil-Electric Locomotives
Cylinder Oil	2000–3500	Steam Cylinders and wherever Heavy Oil is Needed

What Properties are Desirable in Oils for Motors?

The two most important characteristics in oils for the bearings of industrial motors are viscosity and that property which prevents wear when the oil film is ruptured or before it forms. So far as the bearing design is concerned, the important factors for proper lubrication are clearances, pressures, and journal speeds, as well as adequate devices for supplying the lubricant.

If motor bearings are lubricated by oil, it is of the utmost importance that the oil should not be too high in viscosity, in order to avoid internal friction in the molecules, with subsequent loss of power. On the other hand, oil too low in viscosity will not "stay put" and will not provide an adequate film to prevent bearing wear and "seizure." Sealed-sleeve or other ring-oiling bearings should be used when the shafts are horizontal or only slightly inclined.

Motor Bearing Pressures, Journal Speeds, and Clearances

Motor bearing pressures may run up to 180 pounds per square inch when the machine is running, in belted service, and from 75 to 125 pounds per square inch in geared service. The load, when the motor is idle, usually varies with the size of the motor, anywhere from 20 to 125 pounds per square inch. In geared motors having two bearings, the load does not usually exceed 100 horsepower at 850 revolutions per minute, but it may be as high as 500 horsepower and more with three bearings. Belted motors usually have two bearings for ratings up to 150 horsepower at 850 revolutions per minute and three bearings above that rating. Hence, "idle load" values are not a factor on belted and geared motors.

Journal speeds may reach 1600 and even 1800 feet per minute. Since such speeds occur in small units, as well as in large units, the lubricant may need to meet the combination of a pressure of 180 pounds per square inch and a speed of 1600 to 1800 feet per minute in continuous operation, and may develop a temperature rise of 45 to 50 degrees C. (80 to 90 degrees F.) or even higher on new journals.

Clearances in horizontal, oil-lubricated bearings vary from 0.0015 inch for small bearings up to 0.024 inch for bearings not over 28 inches in diameter. In grease-lubricated bearings, clearances range from 0.005 inch for small bearings to 0.020 inch for a 9-inch diameter. Clearances range from 0.002 inch for small vertical bearings to 0.017 inch for a maximum diameter of 28 inches.

Grease-lubricated bearings are used in motors that operate at an angle. Naturally the clearances for bearings lubricated with grease are larger than when oil is used. For outdoor service, low temperatures may prevail and compression grease cups may have to be used.

Lubricating Waste-Packed and Ball-Bearing Motors

Waste-packed bearings are used in motors when high speeds make it difficult to keep the bearings oil-tight. Wool waste saturated in straight-run mineral oil having a viscosity of from 180 to 210

seconds at 100 degrees F. insures good lubrication. Bearing clearances should be very small with such bearings on account of the poor oil feed, as compared with ring-lubricated bearings. As regards waste-packed bearings, only the best grade of wool waste, thoroughly saturated with oil, should be used (about 1 pound of waste to 2 pounds of oil). This should be applied with a packing iron to insure close contact of the waste with the bearing.

Ball bearings of motors may be either grease- or oil-lubricated. The lubricant must cling to the balls and races, must not "break down" under the churning action of the bearings, and must resist great temperature changes without congealing (if oil) or liquefying (if grease). It should be commercially obtainable anywhere.

Vertical motor bearings should be oil-lubricated, and usually depend upon centrifugal action for circulating the lubricant. Oil meeting the requirements of horizontal bearings will fulfill the necessities of vertical bearings. Clearances should be considerably less than in horizontal bearings to avoid vibration. Oils suitable for lubricating these bearings may be refined from many kinds of crude oils. From the commercial point of view, it would be impracticable for manufacturers to market industrial motors that would require highly specialized training in lubrication on the part of the operator. With this in mind, motors are tested with an ordinary commercial grade of oil.

An Oil Suitable for Industrial Motors

For the lubrication of industrial motors, satisfactory service will be obtained from a well-refined pure petroleum oil, free from acid, sediment, dirt, or other foreign material. It should have a Saybolt universal viscosity of from 180 to 210 seconds at 100 degrees F., and a pour test of 35 degrees F., if the motor is to operate at normal temperatures; 0 degrees F. if the motor is subjected to periodic freezing temperatures; and minus 40 degrees F. if the motor is to operate continuously under freezing temperatures. Under the latter condition, a viscosity of 80 to 110 seconds at 100 degrees F. is satisfactory.

Too Many Brands Should Not be Stocked

There is a tendency to stock too many brands of lubricants. New machinery is often received with a special lubricant specified by the builder. Almost invariably these special oils cost more, if due to no other reason than that savings may be effected through purchasing oil in bulk. In one industrial plant, the cost of stocking a single item is estimated at $55 a year, regardless of the quantity involved. While this figure may be exceptionally high in comparison with other plants, it is essential, in any plant, to keep the number of brands to a minimum. Special lubricants can generally be replaced by standard brands.

Considering the fact that some industrial plants have mechanisms requiring practically the whole range of lubricants, the actual number stocked can be either large or relatively small. The accompanying table is indicative of what may be accomplished in reducing the variety of oils stocked. Approximate viscosities are given to show how well the entire range may be covered.

Choosing between Oil and Grease

Whether to select an oil or a grease for a given application is often a problem, as, in some equipment, either may be used with satisfactory results. The relative cost should then be the determining factor. As a rule, grease costs more than oil. It might even pay to redesign some bearings for oil instead of grease. In applications subjected to heat, even heavy oil will run away. Here grease has a decided advantage. [Future articles by the same author will deal with tests to be made in checking the properties of oils and greases and with methods of insuring efficient lubrication.]

The Westinghouse Industrial Relations Program

At a time when so much is being said about unemployment insurance funds and the responsibility of industry for its stable employes, it is of interest to learn how the Westinghouse Electric & Mfg. Co., has for many years, maintained different funds for the benefit of its employes. The comprehensive program pertaining to industrial relations includes a relief fund to provide for contingencies of sickness or injury while off duty; a savings fund paying 6 per cent interest up to a certain savings total; a pension fund; a group insurance plan; an education and training plan; a building and loan program through which 711 homes have been financed and built; an incentive plan for executive and supervisory forces; and a health plan which includes safety measures and medical service.

In addition, there is a dismissal allowance made for employes of ten years' service or more, if their employment is terminated on account of business depression or changed methods of operation. This allowance is based upon age, length of service, and rate of earnings. The upper range of this allowance equals one year's salary or earnings.

More than 37,000 employes are covered by group insurance totaling $98,000,000; over $4,000,000 has been paid to beneficiaries since the inception of this insurance plan in 1920; $700,000 was paid out in 1930 as relief benefits because of accidents while off duty or illness; and pension payments amounted to $165,000 in that year. The total cost of this entire program averages nearly $2,000,000 a year, or approximately 2.75 per cent of the total payroll.

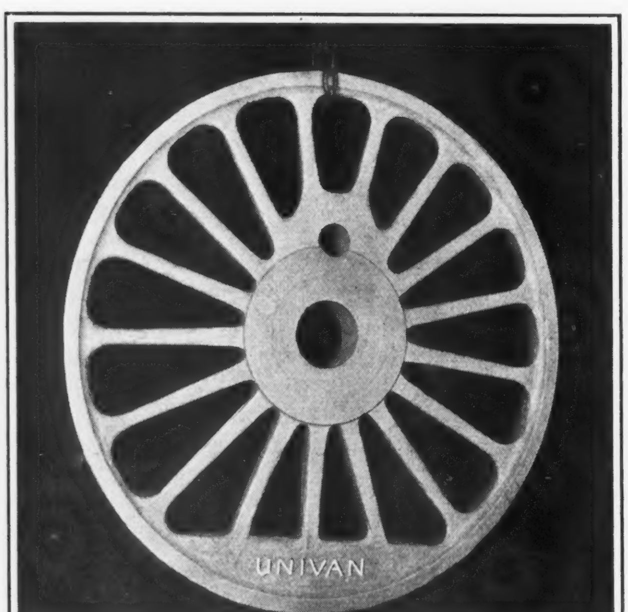
Special Tools and Devices for Railway Shops

Recommended by Railway Shop Superintendents and Foremen

Cast-Steel Driving-Wheel Centers

In the accompanying illustration is shown a locomotive driving-wheel center of a special alloy cast steel used by the Union Steel Casting Co., Pittsburgh, Pa., for locomotive frames, wheel centers, cross-heads, and other castings that are subjected to severe shocks and stresses. This company has applied the registered trademark "Univan" to the special alloy steels used for the locomotive parts mentioned, and guarantees that the metal will equal or exceed the following minimum physical characteristics: Tensile strength, 90,000 pounds per square inch; yield point, 60,000 pounds per square inch; elongation in 2 inches, 25 per cent; and reduction of area, 50 per cent.

The steel is made by the open-hearth or electric furnace process. After the castings have become cool, they are heated uniformly to the temperature required to refine the grain. Test specimens are attached to the castings for checking the physical properties after heat-treatment. It is interesting to note that eighteen specimens bearing five different heat numbers showed an average tensile strength of 95,278 pounds per square inch; an average yield point of 65,514 pounds per square inch; an elongation in 2 inches of 27 per cent; and a reduction of area of 54.9 per cent.



Locomotive Driving-wheel Center Cast from a Special Alloy Steel

Revolving Lapping Plate for Locomotive Repair Shops

By EDWIN G. JONES, Atlantic Coast Line Railroad
Tampa, Fla.

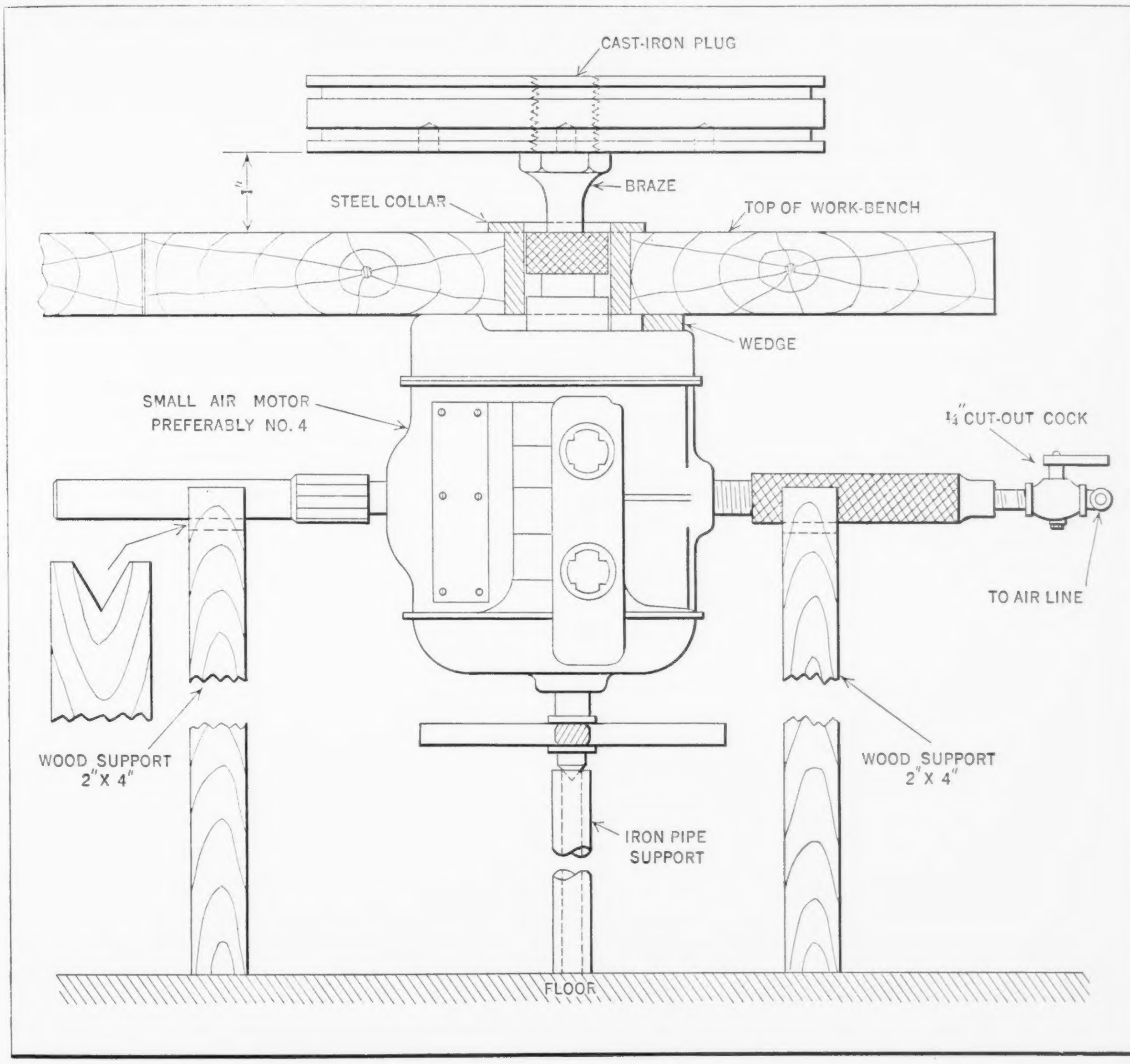
A lapping plate can be used to advantage in repair shops, particularly in locomotive repair shops. In the air-brake repair room, many flat-surfaced valves of brass and valve seats of cast iron require grinding and lapping. These valves and seats are often in such a condition that they require machine work on the lathe. It is seldom that work machined with turning tools can be put back in service without being finished by lapping. In many cases, this operation consumes several hours. When there is a large amount of repair work of this kind, hand-lapping operations become quite laborious, and as a result, the cleaning of work is often neglected.

Some of the larger locomotive repair shops have commercial lapping machines, which are indeed an asset to any repair room. Numerous repair jobs on triple valves and U-C type valves must be handled in the air-brake rooms in the car yard. Sometimes dozens of "cut valves" come in that require lapping before they can be put back into service.

In the accompanying illustration is shown a simple revolving lapping machine that can be made at a low cost and will be found very satisfactory for the class of work described. Almost every air-brake room has an extra air motor, and, if not, one can be secured from the tool-room. This lapping plate does not require great speed nor power, and for this reason, a small motor is desirable, preferably one of the No. 4 size. The face of the lapping plate is made of an old piston from a 9 1/2-inch air compressor. This is used because it is of cast iron and the single hole in the center can be readily filled up with a threaded cast-iron plug.

After the hole in the piston has been drilled and tapped, the threaded plug is screwed into place and an old drill or reamer shank, which fits the air motor, is brazed to the cast-iron plug. The piston is then trued up in the lathe and machined on the face only. The machined face can now be brought to a true surface by the aid of a scraper, using a master plate and Prussian blue to locate the high spots.

A steel collar is inserted in a hole cut in the work-bench, as shown in the illustration. This collar prevents side play or wobbling. The air motor is blocked up by means of 2- by 4-inch wood props and a piece of pipe, as indicated. There are many ways, however, in which it could be held in place. The motor is connected to the air line, and a 1/4-inch control valve is used to control the speed of the motor. This valve may be arranged for foot operation by means of a pedal and a coil spring. When the equipment is assembled as shown in the illustration, it is ready for service.



Pneumatically Driven Lapping Plate for Locomotive Repair Shop

A medium grinding compound is applied to the plate for the first lapping operation. For finish-lapping, a fine grinding compound is used. If the grinding compound becomes thick and gummy during the lapping process, a small amount of kerosene oil may be added. This thins the compound very nicely and improves its cutting qualities. To obtain the best finish, a liquid brass polish is applied to the plate, after which the valve is subjected to the final lapping operation. A perfectly lapped valve can be obtained by following this procedure.

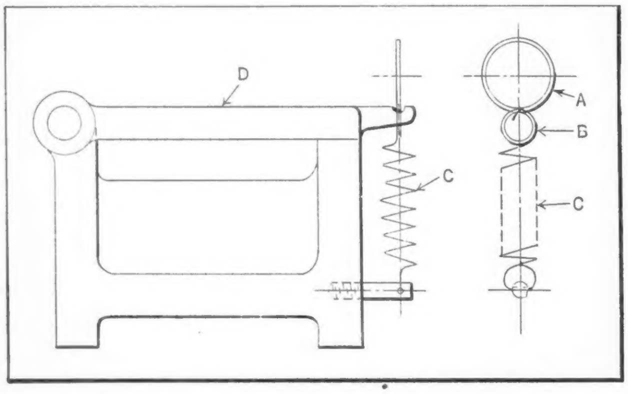
To keep the lapping plate in good condition, the valves being lapped must be traversed across the entire face of the plate, so as to avoid wearing grooves on its surface. To insure good results, the plate should be checked or tested occasionally for flatness by means of a master plate and Prussian blue. When the plate is found to be out of true, it can be straightened with a scraper or lapped with two other similar plates.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Tension Spring with Finger Ring

Anyone who has attempted to uncouple a stiff tension spring will appreciate the advantage of having it constructed with a finger ring *A*, as shown in the accompanying illustration. The ring *A* and



Jig with Latch Held in Place by Spring having a Finger Ring

loop *B* are each formed by two coils of the end of the wire that forms the spring *C*. The pivoted latch *D* of the jig is held in contact with the work by the tension of the spring when the loop *B* is passed over its outer end. By placing a finger in ring *A*, the operator can easily remove the spring from the latch or replace it. Although the finger ring shown is provided for a spring used on a jig, it is obvious that this feature can be applied to springs employed for many purposes. M. H.

Removing Defects in Worm-Gears

Worm-gears that "run out" or do not run smoothly may be corrected with a tool made of non-shrinking steel or Nitralloy, machined exactly like one of the worms and gashed to give as many teeth as possible without making them too weak. The teeth are not backed off, and after hardening the tool, the faces of the teeth are ground. If the threads of the worms are ground, the tool is also ground in the same way.

The complete tool is mounted on the milling machine spindle, and the work put on a shouldered arbor between centers without any dog, so that it is free to turn when engaged by the revolving tool. After lining up the tool and work, the table is fed vertically upward very slowly until the distance between the center of the worm-wheel and the center of the tool is correct. The metal removed is in the form of a fine dust, and the worm-gear will have a "run-in" appearance. A very smooth-running gear, with a good bearing surface, is obtained by this method. Care must be taken to leave very little stock to be removed by the finishing tool.

L. F. S.

Adapting Power Hacksaw to Oxy-Acetylene Cutting

A power hacksaw was temporarily converted into an effective oxy-acetylene cutting machine for cutting off stock by simply securing the cutting torch to the hacksaw frame. The stock to be cut off was clamped in the regular vise, and the cutting torch fed across the work at the proper cutting speed by turning the driving pulley of the machine by hand. A stop was provided for setting the cutter of the torch the correct distance from the work.

Preston, Australia C. J. DROLZ

Vernier Caliper Attachment for Testing Dovetails

In Figs. 1 and 2 is shown an attachment for a vernier caliper which is used with very satisfactory results in testing or inspecting electric generator

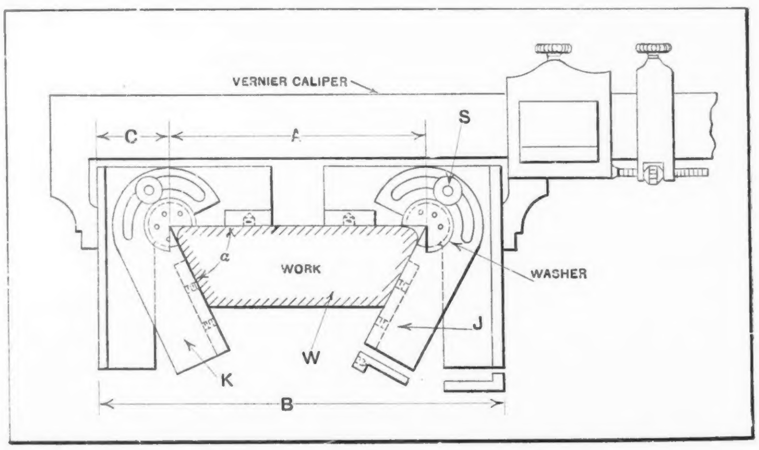


Fig. 1. Vernier Caliper with Attachment for Measuring Dovetail

parts having dovetail fits, such as are found on the rotor spider and the laminations. The attachment is employed regularly for testing both the tongue and the groove members which are required to have a close dovetail fit, and is adjustable for measuring

dovetails having sides inclined at angles of 45, 60, and 80 degrees.

In Fig. 1 is shown a vernier caliper with the attachment in position for measuring the dimension *A* of the tongue member *W*, while in Fig. 2 the attachment is shown in position for measuring dimension *A* of the groove in which the tongue is required to be a good dovetail fit.

The knurled knobs *S*, Fig. 1, are used to clamp the right- and left-hand members *J* and *K* in the proper position for measuring dovetails of any angle *a*. As shown in the illustration, the vernier caliper is used to find the measurement *B*, from

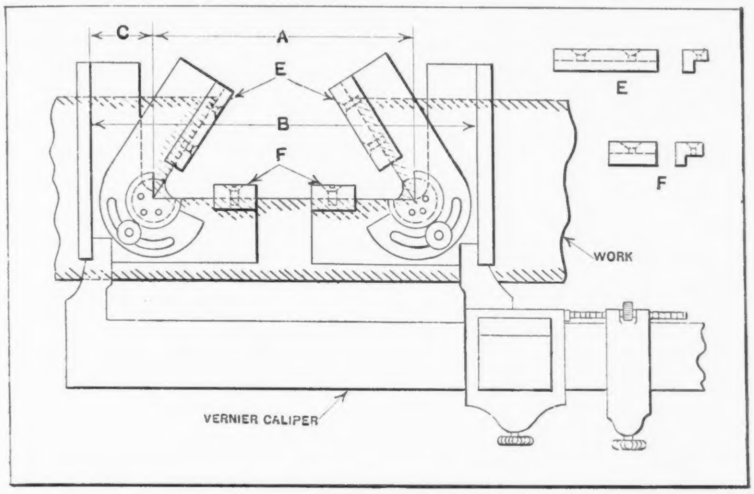


Fig. 2. Method of Using Vernier Caliper for Measuring Groove Member of Dovetail

which dimension *A* is obtained by subtracting $2 \times C$ or $2 \times 0.500 = 1.000$ inch.

In the case of the dovetailed groove shown in Fig. 2, 0.700 is subtracted from measurement *B*, as dimension *C* equals 0.350 inch. For measuring the groove, the attachment is provided with the gaging contact members *E* and *F*.

Tokio, Japan K. TAKAHASHI

Lapping Threaded Parts with a Tapping Attachment

The reversing feature of a standard tapping attachment for drill presses makes the attachment unusually well adapted for lapping threaded parts, such as thread gages, precision screws, etc. The part or lap, as the case may be, is gripped in the chuck of the attachment, which is mounted either in a lathe or a drill press. The reversing movement of the lap along the axis of the work is obtained in the same way as in tapping.

Cincinnati, Ohio F. J. WILHELM

A Slide-Rule Kink

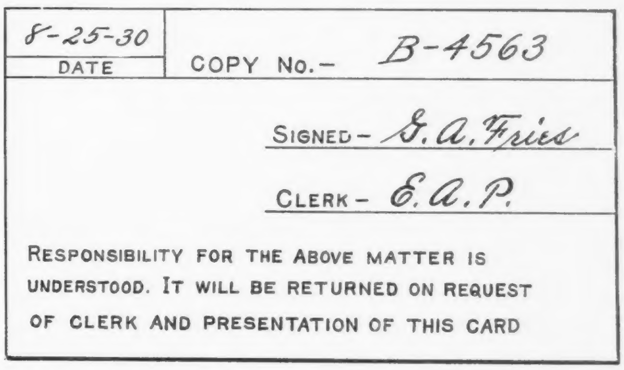
Most calculations made on the slide-rule by draftsmen involve only a few figures. In many cases, these figures are simplified by approximation, and so lend themselves to a simple time-saving manipulation as follows: In using the C and D scales for multiplication and division, it often happens that the slide must be transferred to the other end of the rule before the calculation can proceed. Rather than reset the slide to the other end, the writer often doubles or halves the figure. In most cases, this gives a figure that obviates shifting the slide to the opposite end of the rule. The result obtained in this manner is then corrected by halving or doubling it, as the case requires. The correction is made by a simple mental process while reading the result, and there is no sacrifice of accuracy. Of course, as with most tricks of this nature, a little practice is required, and it should not be used in making complicated calculations.

Auburn, N. Y. W. S. BROWN

Recording Removal of Drawings from Engineering Files

Several years' experience with different systems of keeping records of the tracings and blueprints taken from the engineering files by the employes has led the writer to select the system described here as being the most satisfactory. Many engineering departments have inefficient methods of keeping these records, which confuse the clerks and cause the draftsmen to waste considerable time. Also, many drawings are lost and must be replaced at additional expense.

The writer believes all this trouble can be practically eliminated by using a simple card file or record system. Such a system requires cards approximately 5 by 3 inches, filled out properly, as



8-25-30
DATE
COPY No.- B-4563

SIGNED- G. A. Fries

CLERK- E. A. P.

RESPONSIBILITY FOR THE ABOVE MATTER IS UNDERSTOOD. IT WILL BE RETURNED ON REQUEST OF CLERK AND PRESENTATION OF THIS CARD

Card Filled out by Employe when Taking Drawing from Files

shown in the illustration, by the one removing the print or tracing from the files. The filled-out cards are simply filed according to the system of numbering the drawings, the filing being done by the clerk whose signature appears on the card.

Philadelphia, Pa. GEORGE A. FRIES

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

X. Y.—Machinery was ordered from a manufacturer. The buyer furnished minute specifications for its manufacture, and the seller guaranteed that it would develop a certain horsepower when installed. The seller manufactured the machinery in strict compliance with the specifications, and it did develop the warranted horsepower when set up in the buyer's plant. However, it fell short of being satisfactory to the buyer, because the manner of its construction did not permit its use in conjunction with other machinery in the plant. The buyer seeks to hold the seller liable for this failure of fitness for the purpose intended. What are the rights of the parties?

Answered by Leslie Childs, Attorney at Law
Indianapolis, Ind.

Since the seller manufactured the machinery according to the specifications furnished by the buyer, and it developed the expected horsepower when installed, it seems clear that the seller complied with the contract. It has been repeatedly held that a mere warranty of specifications of machinery does not constitute a warranty of fitness for the buyer's purpose. It is well known, and recognized by the courts, that the question of the fitness of machinery frequently involves engineering problems not apparent in the specifications alone, and unless a seller also guarantees fitness he may not be held liable. (188 N. W. 481)

Machining High-Speed Steel

W. D.—1. What is the Brinell hardness of 18 per cent tungsten high-speed steel as it comes from the mill, thoroughly annealed?

2. What cutting speeds would be recommended for the turning, milling, and drilling of such steel, using cutting tools made from 18 per cent tungsten high-speed steel?

Answered by A. H. d'Arcambal, Consulting Metallurgist, Pratt & Whitney Co., Hartford, Conn.

1. Our specifications call for high-speed steel with a maximum Brinell hardness of 241. Brinell hardness does not entirely control the machineability of high-speed steel, a great deal depending upon the grain size. For this reason, it is the practice of some concerns to re-anneal their high-speed steel in order to obtain better machineability.

2. The question of cutting speeds is difficult to answer because of the many variables encountered, such as the type and condition of machine tool equipment, the kind of cutting fluid used, etc. The following figures represent general practice: Turning, 60 feet per minute with a feed of 0.007 to 0.009 inch per revolution; milling, 85 to 125 feet per minute with a feed of from 2 to 5 inches per minute; drilling, 60 to 70 feet per minute; reaming, 30 to 50 feet per minute. Under ideal conditions, when great accuracy is not important, these figures can be increased as much as 25 per cent.

Answered by N. B. Hoffman, Metallurgist
Colonial Steel Co., Pittsburgh, Pa.

1. The Brinell hardness of an annealed high-speed steel would depend somewhat on the cross-section of the annealed sample. Our company furnishes annealed high-speed steel rounds and flats, in sizes having a maximum diameter or thickness of 2 inches, in a Brinell hardness number range of from 212 to 235. Round or flat sections having a diameter or thickness greater than 2 inches are furnished in a Brinell hardness range of from 217 to 255. Sheet and plate stock is furnished in a Brinell hardness range of from 212 to 235.

2. For milling high-speed steel, a cutting speed of from 30 to 40 feet per minute is recommended; for drilling and turning, a cutting speed of from 30 to 50 feet per minute can be used. The speed, of course, depends somewhat upon the size of stock to be cut and the depth of the cut.

Answered by a Leading Manufacturer of
Metal-Cutting Tools

1. Tungsten high-speed steel, as it comes from the mill well annealed, will usually have a Brinell hardness range of from 225 to 255.

2. The following speeds are regularly used, but depend, of course, to some extent, upon the size of the work being cut, the equipment used, and other factors that ordinarily should be considered in selecting cutting speeds: Turning, 50 to 90 feet per minute; milling, 60 to 75 feet per minute; drilling, 45 to 55 feet per minute.

Protecting Metal against Chlorine Gas

A. M.—Is there any plating or coating process that will protect brass, steel, and cast iron against the corrosive effects of chlorine gas? Would chromium-plating resist the effects of this gas? If not, what other means are available that may be used for this purpose?

This question is submitted to readers who may have had experience with this class of work.

Automatic Arc Welding with the Shielded Arc

Numerous Tests Indicate that Shielded-Arc Welding Increases Strength of Welds and Gives Added Resistance to Corrosion

By A. F. DAVIS, Vice-President
The Lincoln Electric Co., Cleveland, Ohio

I HAVE read with interest the article on page 270 of December MACHINERY entitled "Automatic Arc-Welding Applications." In this connection, the process that is known as welding with the shielded arc may be of interest.

It is common knowledge to those familiar with arc welding that the molten weld metal, as it is being deposited, has an affinity for oxygen and nitrogen. Since the arc stream is maintained in an atmosphere composed chiefly of these elements, oxidation proceeds at a high rate during the passage of the weld metal from electrode to work. It is the presence of the oxides and nitrides in the weld metal that impairs its strength, ductility, and resistance to corrosion.

If the molten weld metal is protected from contact with atmospheric oxygen and nitrogen during the process of deposition, the weld will be free from oxides and nitrides. Thus an arc, completely shielded from oxygen and nitrogen, deposits weld metal superior to that deposited by an ordinary arc.

Our company has developed, and had in rather wide use for several years, a process of automatic welding with the shielded arc. By its use the metal is completely shielded from the oxygen and nitrogen of the air while the metal is in a molten condition. As a result, greater strength, ductility, and resistance to corrosion are secured.

A great number of tests have been made to determine the value of this process of welding. In one instance, test bars were made from half-inch plates of structural steel having an ultimate tensile strength of approximately 55,000 pounds per square inch, an elastic limit of 30,000 pounds per square inch, and an elongation of 22 per cent in 2 inches. The test bars were butt-welded, the filler metal being of the same composition as the plates.

Eight samples were welded and it was found that the ultimate strength of the welds in every case exceeded the maximum ultimate strength of the rolled steel. In fact, the average ultimate strength of the welds was 78,287 pounds per square inch and the average elastic limit was 58,275 pounds per square inch. The average elongation in 2 inches was 21.25 per cent, the lowest figure in the tests being 12 per cent, and the highest 30 per cent.

Many other tests have been made giving similar results on other test pieces. In one instance, small holes were drilled through the weld in the test piece. The weld resisted a stress of 74,100 pounds per square inch, and the only indication that stress was imposed on the weld was the fact that the original drilled holes had been pulled into an oval shape. This proved graphically the high ductility of the metal at the weld.

The effect of corrosion on the weld metal and the parent metal is an important factor, and one that should be given serious consideration in the determination of the automatic arc-welding process to employ. The rate of deterioration as a result of corrosion is often an influencing factor in the sale of an arc-welded product that will be subjected to the effects of corrosion.

The effects of corrosion on 1/2-inch plates butt-welded by the metallic arc process and the shielded arc process were tested by a 120-hour immersion of the test samples in a 20 per cent solution of sulphuric acid. The samples subjected to the test were cut from the same piece of structural steel plate.

Inspection of the corroded welded samples revealed that the corrosion of the metallic arc-welded metal was pronounced, and in addition, the parent metal was far more corroded than the parent or plate metal in the sample welded by the shielded arc process. This pronounced corrosion in the metallic arc-welded sample was due to the presence of foreign materials, mainly iron oxide, in the weld metal.

When weld metal containing foreign substances comes in contact with a solution such as the one mentioned, an electrolytic action takes place due to the difference in potential between the foreign material and the metal. This action causes the deterioration of the parent metal. The effect of corrosion on the sample welded by the shielded arc process, as revealed by the test referred to, was practically negligible as compared with the effect on the other sample. This is due to the fact that in the shielded arc process, practically all foreign material, especially iron oxide, is excluded from the weld metal. Thus no electrolytic action is set up that would result in deterioration by corrosion.

* * *

Engineers will be interested in an unusual feature in connection with the mercury boiler installation to be built at Schenectady, N. Y. The equipment will be located outdoors to reduce building and structural costs, which, for steam power plants, amounts to from one-quarter to one-third of the total investment. The use of outdoor power stations, it is believed by the engineers in charge of this development, is a logical trend, especially for very large boiler and turbine units, the main object being to put the greatest part of the capital available into working machinery, so as to obtain the largest possible return on the investment. Many classes of electrical apparatus in the past have been installed outdoors; and when properly designed for the purpose, this has proved quite satisfactory.

Forming Compound Bends in a Progressive Die

Die Composed of Separate Station Units, One of which is Collapsible to Prevent Locking of Formed Part in Die

By EDWARD HELLER

FREQUENTLY, parts to be made in the power press seem so complicated that it is difficult to imagine how they could be produced in less than two or three dies; yet when the problem is studied, it is found that they can be made by performing all the operations in one die.

For example, in the die shown in Fig. 2, the parts to be made are connected by the 1/2-inch neck *E*, and in this manner are carried along to their respective stations until all the operations are performed. The slotting operation at the last station, as shown at *F*, removes the neck *E* and also slots the ends of the parts, which then drop from the die at the left end of the press.

This job is done at five working stations, but since there is one "skip" station, the die actually has six stations. Formerly three separate dies were required for this work, the first being of the two-station type for piercing and blanking, while the other two formed the part.

Sequence of Operations in Die

The lay-out of the strip as it passes through the die is shown clearly in the upper part of Fig. 2. At Station 1, each piece is partially blanked out, both sides of the strip being notched and the center hole pierced. In order to provide a wider support for the center portion of the blanking die, the clearance holes in the supporting die-plate are sloped outward, as indicated by the contour at *G*. At Station 2, the remaining two holes are pierced. Passing to Station 3, the offsets on each side of the center portion of the part are made, and the ends of the lugs are formed. The final forming of the lugs is done at Station 4. Station 5 is the "skip" station which facilitates the location of the sixth station for severing the part from the strip.

Referring to the plan view of the die, the strip is passed between an outboard guide (not shown) on the bars *A*, and under the stripper plate *B*, and is slid along until it comes in contact with the stationary tool-steel gage-blocks *C*. Then, upon the descent of the punch, the center hole is pierced and both sides of the strip are partially blanked or notched, leaving the two shoulders *D*.

These shoulders are the gage points which come in contact with the gage-blocks *C* and locate the strip for the next operation. This method of gaging is very accurate, and is fool-proof to the extent that the strip cannot be accidentally passed by its station. However, the operator must take the precaution to hold the strip against the gage-blocks, as otherwise the die is likely to be damaged.

Design of Collapsible Forming Die

A die of this type presents a great many problems in design and construction. The first two stations, which do nearly all the cutting, are of sectional design to facilitate construction as well as upkeep. The station at which the final forming of the lugs is accomplished is the most complicated part of the die. One of the bad features of this forming operation is that the work is wrapped around the lower part of the die, and the central offset enters the recess in the top faces of the die. To free the work from the die, the die unit was designed to collapse with the ascent of the press ram.

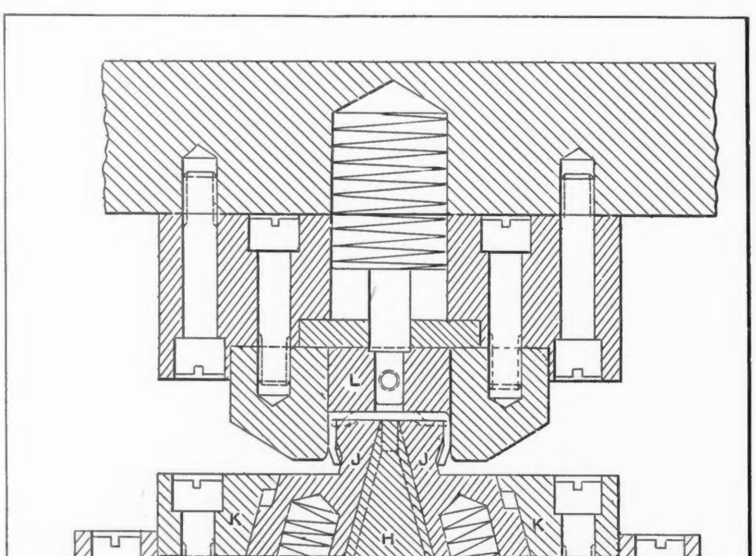


Fig. 1. Section X-X (Fig. 2), Showing the Action of the Die in the Final Forming Operation

This unit, a section of which is shown in Fig. 1, consists of three

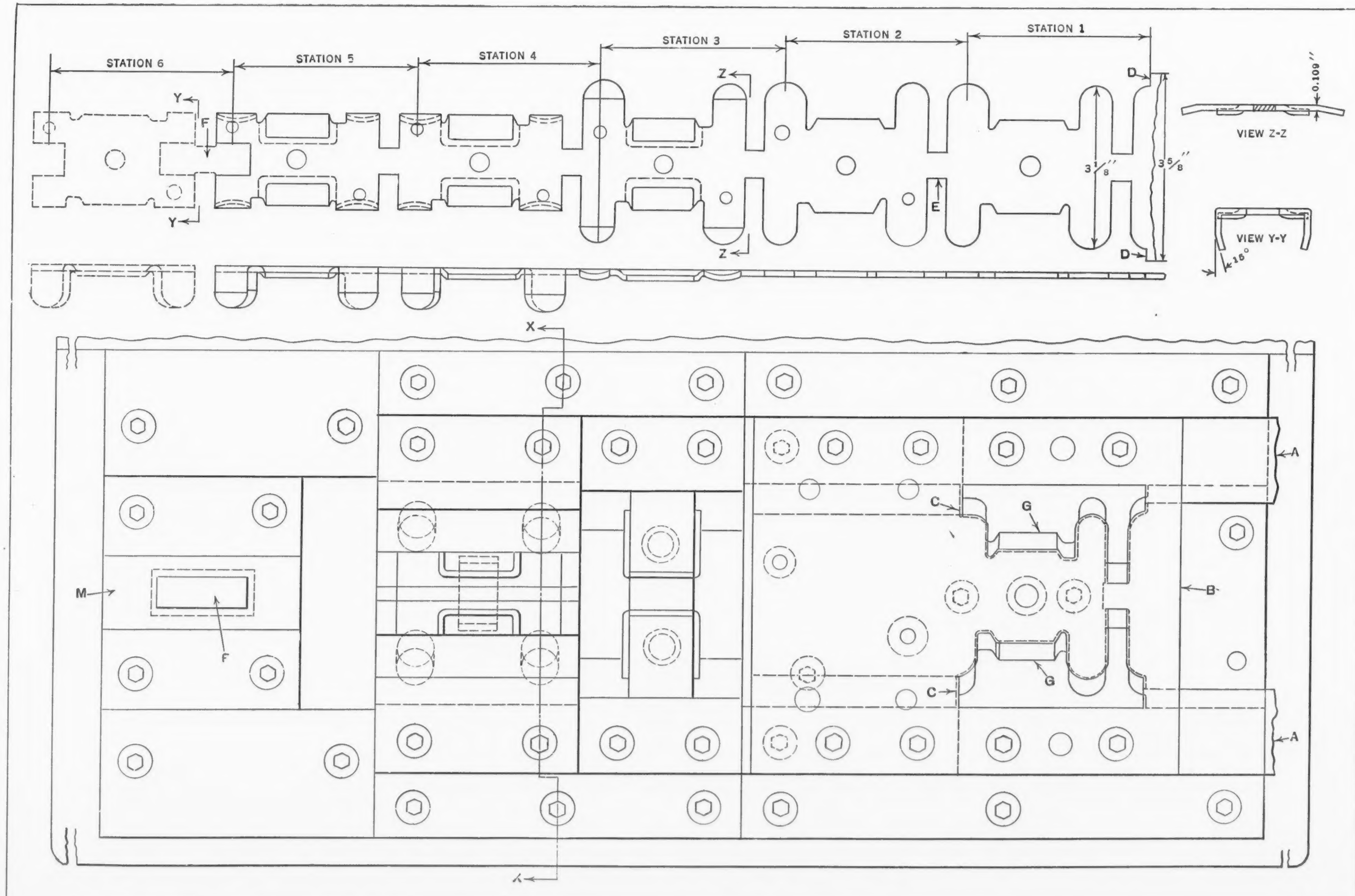


Fig. 2. Plan of Progressive Die, Showing how Work is Pierced, Blanked, and Formed before being Severed from the Strip

parts, a central wedge H and the two slide dies J. These slide dies are held in the operative position by two light springs, and have a movement of about 1/4 inch. They are confined in their path of motion by the gibs K. When the ram of the press is at the top of its stroke, the slide dies approach each other enough to allow the formed channel in the work to pass over the depressions in the top surfaces of the dies.

The punch at this station is equipped with a knock-out L, actuated by a heavy coil spring. This knock-out prevents the work from sticking in the punch and deforming the strip on the upward stroke.

All the die units are designed in such a way that any one of them can be removed without interfering with the others. This feature is not only a great convenience, but a necessity. In the first place, it would be difficult to line up all the stations at the required heights if the die were made in one piece; and since this die combines blanking and forming, it is necessary to realign the various stations every time the cutting edges are ground. This realignment may be done by simply shimming up one die part or lowering another. The end of the die-shoe is beveled at M (Fig. 2) to allow the finished part to slide off into a receptacle at the left of the press.

On a 75- to 90-ton press, a die of this type will produce 1000 to 1200 parts per hour, and if the correct grade of steel is used in making the die and the strip is lubricated properly, the die should produce 100,000 to 200,000 pieces before requiring attention.

* * *

Do not waste time on a man who is afraid to show you because he fears that you will get his job.—*The Shop Review*

Machine Demonstrations Right at Your Door

Believing that prospective customers can learn more about the actual advantages of a machine from one practical demonstration than in any other way, Andrew C. Campbell, Inc., Bridgeport, Conn., decided to carry the machines it manufactures right to the doors of industrial plants in which they could be used to advantage, and there prove the possibilities of the machines.

With this end in view, the company fitted out the big motor truck shown in Fig. 1 with a nibbling machine and a cut-off machine, as well as electric equipment for operating them. The rear part of the truck, which is seen in Fig. 2, comprises the demonstration room. Between this room and the driver's cab, there is a space that contains a generator for producing electric current to operate the machines.

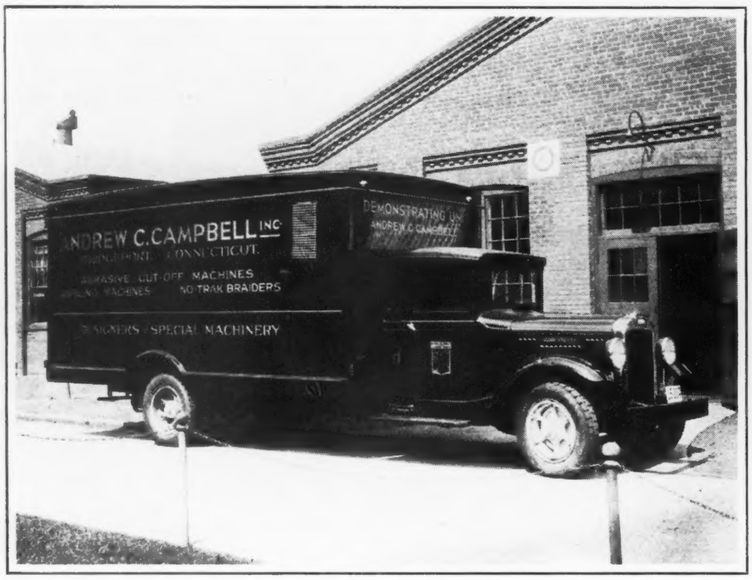


Fig. 1. Motor Truck that Carries Machines to the Doors of Industrial Plants for Demonstration

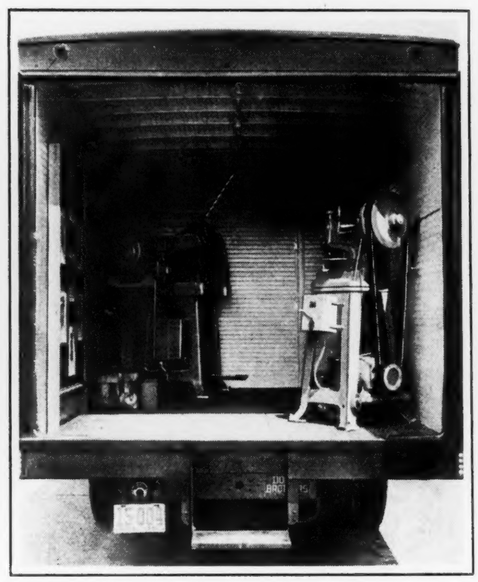
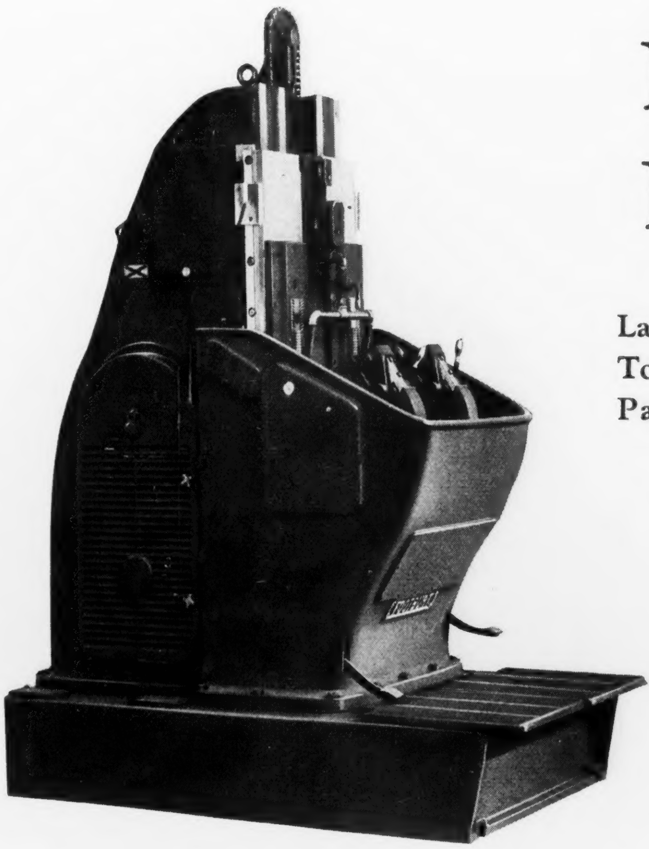


Fig. 2. View Inside the Truck, Showing the "Demonstrating Room"

* * *

How to Nitride Parts of an Object

In nitriding, it is frequently desired to "blank off" some portion of a machine part, so that it will not become hardened in the nitriding process. To do this, the portions that are to be kept soft are coated with tin, as the gas used in nitriding will not penetrate the tin. The tinning is done by dipping the steel part in molten metal. The problem then is to prevent the tin from sticking to such parts of the object as one wishes to become hardened. As tin will not stick to Bakelite lacquer, the portions that are to be hardened are first coated with Bakelite lacquer AL-3128. The lacquer does not prevent the nitrogenous gas from penetrating the steel, and therefore does not interfere with the nitriding process.



New Shop Equipment

Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts, and Material Handling Appliances

Footburt Duplex Surface Broaching Machines

Surface or external broaching machines with two broach slides, one of which moves downward while the other moves up, thus providing a continuous cutting action, have been brought out by the Foote-Burt Co., Cleveland, Ohio. These machines are made in two sizes. The No. 1 machine is designed for a power input of from 5 to 7 1/2 horsepower, and the No. 3 for a power input of from 15 to 20 horsepower. The No. 1 machine is capable of removing 3.3 cubic inches of mild steel per minute, while the No. 3 has a capacity for removing 8.6 cubic inches of mild steel per minute. The speed of the machines is limited only by the ability of the operator to reload the fixtures.

The two broach slides of these machines counterbalance each other. They are joined by a spiral driving pinion which engages a rack on each slide.

The broach is of a heavy back-type construction, and is so designed that it is possible for one tool to take rough, semi-rough, and finish cuts. As an example, on a certain job it might be necessary to remove 3/16 inch of metal from a given surface. If the broach had eighty teeth, the lower ten teeth might be designed to have a rise of 0.005 inch per tooth, and the next sixty teeth to have an average rise of 0.0025 inch per tooth. The upper ten teeth could then be used for finishing or sizing, and would have no rise. The broaches, in all cases, are designed for the job, so as to take care of individual conditions.

When it is necessary to sharpen the broach, it can be removed by withdrawing a few socket-head cap-screws. In sharpening, only the edges are touched up on the grinding wheel. The broach can be quickly reassembled in the locating groove of its holder. On account of the slow cutting speeds, which range from 10 to 40 feet per minute, a long broach life is obtained. As many as 50,000 pieces have been broached per grind.

The broaches are usually built up in sections. For instance, a broach 30 inches long would be composed of five sections, each 6 inches long. After many grinds, the lower section of the broach, or the roughing teeth, are discarded and the remainder of the broach moved down. A new section is then put in at the top for use as a "finisher." This method provides an entirely new broach by supplying a single section.

The machine base forms a large coolant tank, and its front platform can be raised to remove chips. Work fixtures located in front of each slide move automatically to and from the broaches. The broaches are positioned for easy loading and unloading. In some cases, they are furnished with hand-operated clamps, while in other instances, it is possible to design the fixtures for automatic clamping. When either slide is at the bottom of the stroke, the corresponding fixture is in the loading position, and a piece is loaded while the slide moves up.

As soon as the piece is in place, a foot-lever is tripped, and then, as the slide reaches the top of its stroke, the fixture automatically moves into the broaching position. If the foot-lever is not tripped before the slide reaches the top of its stroke, the fixture will remain in the loading posi-

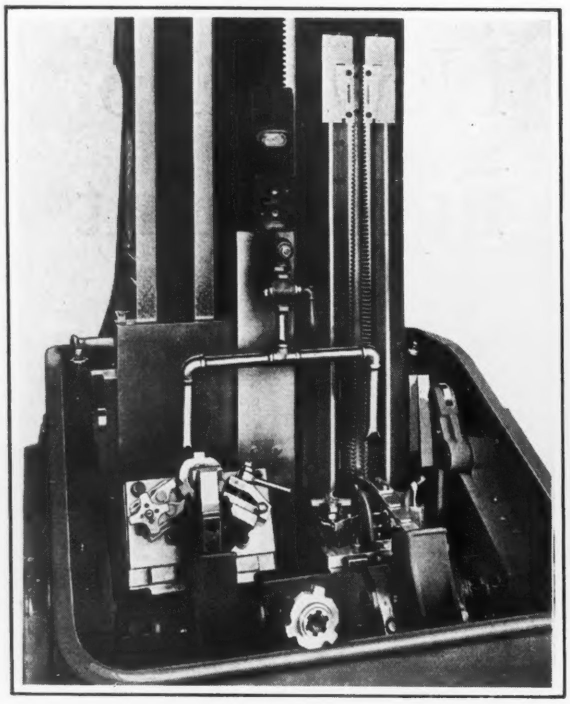
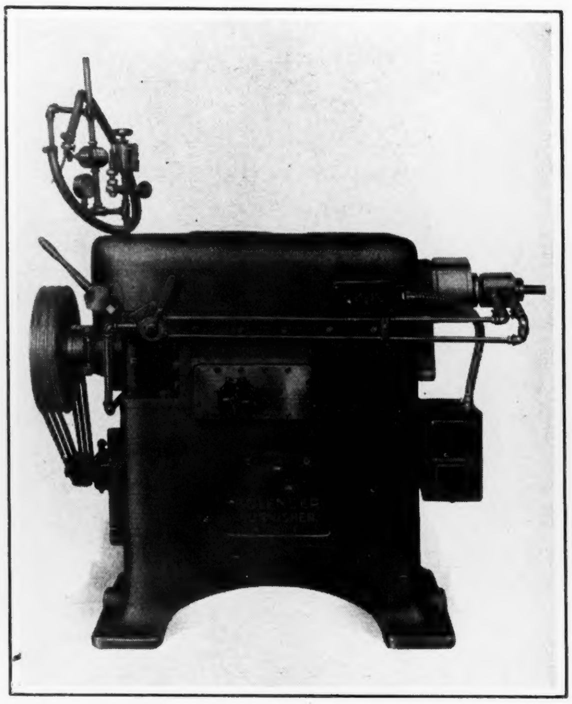


Fig. 1. Close-up View of the Two Broach Slides on the Footburt Broaching Machine



Bolender Semi-automatic Burnisher for Gears up to 8 1/2 Inches Outside Diameter

tion until the next cycle is started. Fig. 1 shows fixtures provided for broaching an automotive transmission clutch. This part is finished in three strokes of the broaches, the operator indexing the part 120 degrees at each stroke.

These broaching machines are driven by a motor designed for frequent reversing. Dogs bolted on the left-hand slide operate a switch to govern the motor reversal. Power is transmitted through a V-belt drive and worm-gearing to the driving pinion which meshes with the steel racks on the broach slides. These slides are oiled by vacuum sight-feed oilers, while the worm-gearing runs in a bath of oil. Coolant is delivered to the work by a motor-driven pump.

Bolender Semi-Automatic Gear Burnisher

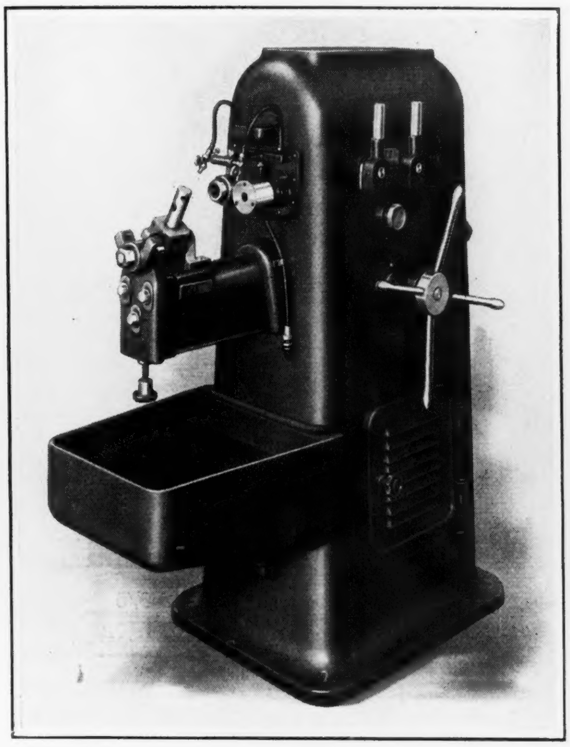
A Model No. 1 semi-automatic gear burnisher has recently been developed by the City Machine & Tool Works, East 3rd and June Sts., Dayton, Ohio, which is smaller than the other burnishing machines made by the company, previously described in MACHINERY. The new machine also differs from the previous models in that it does not have a full-automatic burnishing cycle, the cycle being controlled by a three-button switch which permits the operator to burnish the work in one direction, reverse it, and then stop the operation.

Although the model is shown in the illustration equipped for air operation, it can be furnished with a hydraulic unit. A built-in coolant system and Timken bearings are standard equipment. Both spur and helical gears up to 8 1/2 inches outside diameter can be handled. This machine is intended for use when the purchase of one of the more expensive models is not warranted by production requirements.

Reading Drilling and Tapping Machine

A machine that has been used for years in the shop of the Textile Machine Works, Reading, Pa., for drilling and tapping set-screw holes and drilling oil holes in pawls, levers, collars, handwheels, etc., without the use of jigs and fixtures, is now being placed on the market by that concern. For drilling and tapping in sequence, the part is mounted on a work bracket, which is swung to the right against a positive stop. The large spider wheel is then turned to advance the knee and work toward the drill in the right-hand spindle of the machine. After the drilling operation, the work and knee are returned to their former position by again using the spider wheel, the work bracket is swung to the left against a second stop, and the work is fed to the tap in the left-hand spindle. In the actual tapping, the work is fed by the tap lead.

For reaming operations, a simple control beneath the shifting handles is employed to lock the tapping spindle and prevent it from moving laterally. Hollow-milling and die-threading can be accomplished by placing a hollow mill in the drill spindle and a button die in the tap spindle.



Two-spindle Machine Designed to Eliminate Jigs in Drilling, Tapping, Reaming, and Centering

Barrett Centrifugal Machine for Washing, Painting, Impregnating, and Other Operations

Centering operations are performed in the same manner as drilling and reaming. High rates of production are a feature of all operations.

Drills from No. 32 to 5/8 inch diameter and taps from No. 6 to 3/4 inch can be employed. Drilling speeds range from about 470 to 1270 revolutions per minute, and tapping speeds from 160 to 435 revolutions per minute. The tap spindle rotates in the reverse direction at the same speed as the drill spindle. The knee has a lateral movement of 8 3/8 inches. This machine weighs approximately 1350 pounds.

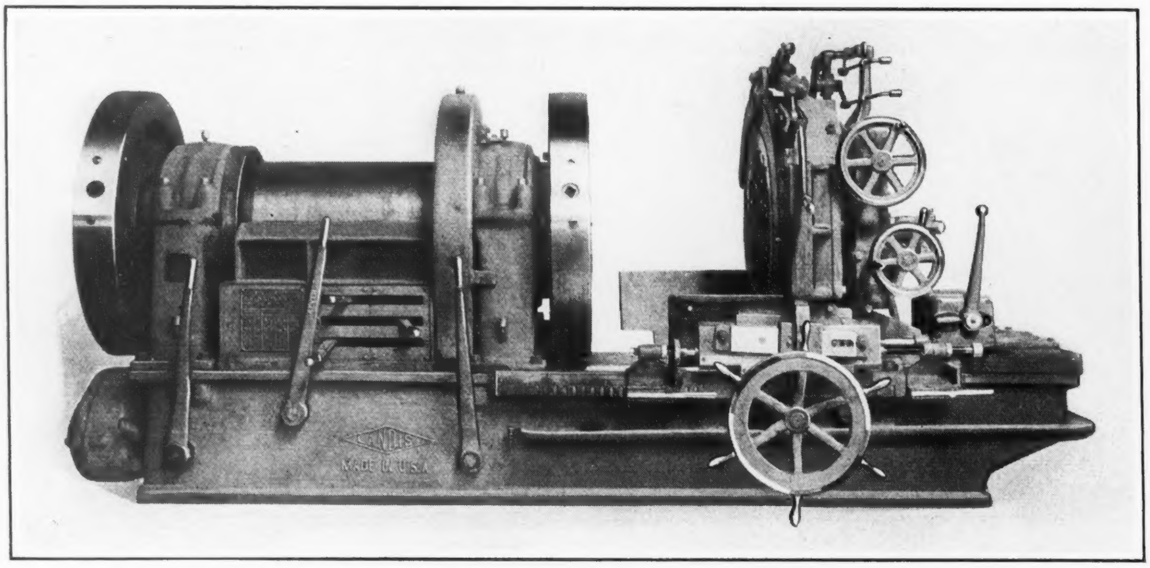
Barrett Centrifugal Machines

Washing, drying, enameling, japanning, painting, impregnating, and similar operations can be performed on small parts by the centrifugal type machines built by the Leon J. Barrett Co., 1475 Grafton St., Worcester, Mass. The different types of standard machines are alike in appearance except for the bowl or container. The operations performed are limited not so much by the weight of the article as by its dimensions and proportions and the capacity of the container. The container revolves the contents at a high rate of speed on a spindle that diverges but slightly from the vertical. The method of sustaining this spindle vertically is partly gyroscopic and partly mechanical.

The heavy-duty models of these machines are capable of handling heavy articles, provided they can be whirled in fair balance. Constant-speed built-in motors provide the power. Safety features insure against danger from carelessness on the part of the operator.

The "Filwhirl" centrifugal enameler will coat a wide variety of articles made from wood, fiber, or metal, and weighing from a fraction of an ounce to several pounds. After the articles are placed in the container, the coating materials enter the machine through a valve. The parts are then immediately and completely coated. Excess coating material is thrown off, so as to leave only the desired thickness of covering, the excess material being returned to the supply tank. The coating materials can be used either hot or cold.

Articles handled in the centrifugal hydrostatic impregnator are positioned and submerged in the impregnating fluid within the closed bowl or container, which is then rotated at a given speed. Centrifugal force, acting radially relative to the axis of rotation, presses the liquid against the wall of the container and thus builds up and maintains its maximum hydrostatic pressure at the largest diameter or at the solid rim. The pressure decreases inwardly toward the center. Hence the impregnating fluid is forced completely through the articles, toward the center, at a rate depending upon the speed of rotation, the radius of the basket, the density of the liquid, and the permeability of the articles. The process is suitable for electric coils and similar products.



Landis Pipe Threading and Cutting Machine with a Capacity for Pipe from 4 1/2 to 13 3/8 Inches Outside Diameter

Landis Pipe Threading and Cutting Machine

A pipe threading and cutting machine of 13 3/8-inch size, equipped with a receding-chaser die-head and a lead-screw, has been added to the line of the Landis Machine Co., Inc., Waynesboro, Pa. This machine has a capacity for pipe casing and tubing from 4 1/2 to 13 3/8 inches outside diameter. Threads of any taper up to 3/4 inch per foot and of any length up to and including 8 inches can be generated.

The receding-chaser feature reduces the cutting strain to that exerted in generating a straight thread of like diameter and pitch, thus assisting in obtaining accurate threads with a high finish. Chasers only 1 15/16 inches wide can be used, a feature that is said to lower the initial chaser cost approximately 50 per cent and add materially to the life of the chasers between grindings. The chasers are interchangeable with those of the 8 5/8-inch machine described in October, 1930, MACHINERY, page 154.

The die-head has a universal adjustment for size. In addition, there is a micrometer adjustment to 0.001 inch for the final setting. The die-head is of the two-cut type, and can be used for roughing and finishing cuts, both of which are controlled by the same receding mechanism.

The sine bar of the taper mechanism is easily adjusted. A tapered plug provides a positive means for locating the sine bar to cut 3/16-, 3/8-, and 3/4-inch tapers. Adjustments for thread length are simple and are made permanent by means of a locking screw. The sine-bar retarding bracket which actuates the taper mechanism is adjustable to suit the length of pipe extending beyond the face of the chuck. An automatic safety device will release the sine-bar retarding bracket should the operator neglect to open the die-head at the finish of the thread.

The lead-screw is located centrally between the guides of the machine and takes the load without binding the carriage. The lead-screw nut is engaged by hand. It can be disengaged either automatically at the end of the cut or by hand. A pitch indicator assists the operator in engaging the nut. The pitch change-gears are housed in a gear-box at the headstock end of the machine.

Oilgear "Cyclematic" Broaching Machines

One of the principal features of the "Cyclematic" broaching machines recently placed on the market by the Oilgear Co., 1301-1417 W. Bruce St., Milwaukee, Wis., is that the work is pulled upward over the stationary broaches. Either one, two, or three broaches can be used. The work is laid flat on a table, being roughly centralized by fixtures. Then after the starting pedal has been depressed, the broaches descend and their lower ends engage mechanically locking sockets. As they descend, they accurately centralize the work.

The table next rises automatically and draws the work upward over the broaches. Near the top of the stroke, the broaches are disengaged from their upper sockets, and as the table completes its movement, the work clears the broach shanks. An ejector-bar then moves forward to remove the work from the fixtures. This ejector can be arranged to drop the work pieces on a chute or conveyor. After the work has been removed, the table automatically travels down to the loading position, the upper broach sockets move downward

to re-engage the upper ends of the broaches, and the broaches are finally lifted into the starting position. During the actual broaching operation, both ends of the broaches are secured rigidly. The broaching forces are always directly in line with the work.

These broaching machines are operated hydraulically and automatically through an Oilgear pump which supplies the power smoothly and with a cushioning effect. Continuous lubrication of the broaches and work is assured by keeping the top of the work flooded with lubricant.

In order to insure continuous fool-proof operation of these machines, all steps of the operating cycle are interlocked. Safety valves can be set for any desired maximum broaching pull. Also, there is a master safety lever which can be used to stop the machine at any point in its cycle. This lever can also be used to reverse the action of the machine at either the normal speed or at a reduced speed.

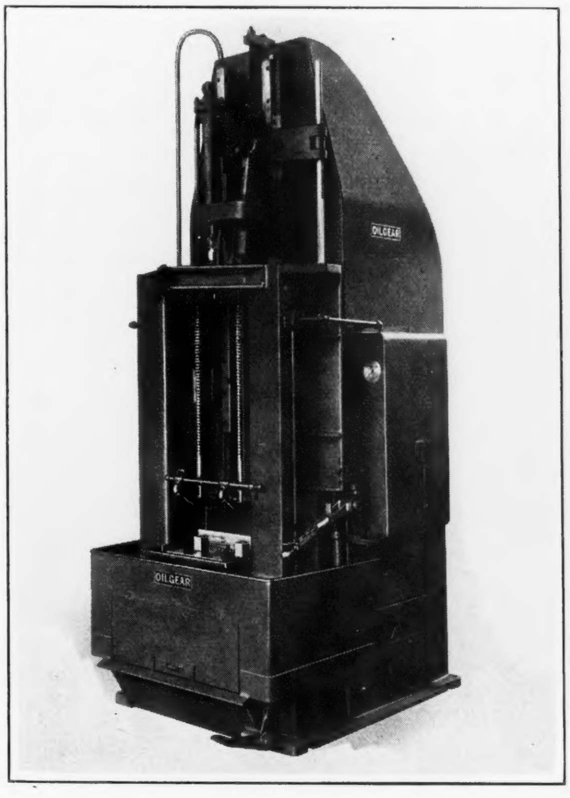
Rough- and finish-broaching, or multiple broaching operations, can be performed at the same time. Because the work is laid flat on the table, the machines can accommodate an unusual variety of work. Both the length of stroke and the cutting speeds are easily adjustable. The pumps, motor, valves, controls, etc., are fully enclosed. The loading level is always thirty inches above the floor, regardless of the length of the broaching tools used, which is an especially convenient feature.

These machines are built in three standard sizes. One size has a normal capacity of 12,000 pounds, a peak capacity of 15,000 pounds, a maximum stroke of 42 inches, and a cutting speed of 34 feet per minute. The second size has a normal capacity of 26,000 pounds, a peak capacity of 33,000 pounds, a maximum stroke of 48 inches, and a cutting speed of from 18 to 32 feet per minute. The third size has a normal capacity of 44,000 pounds, a peak capacity of 55,000 pounds, a maximum stroke of 54 inches, and a cutting speed of 29 feet per minute.

Niagara Electrically Controlled Double Crank Press

An electrical control has been provided on a double crank press of large size recently built by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Electric operation is effected by an electromagnetic clutch and brake which operate in conjunction with each other. There is a push-button control of the slide motion, so arranged that any of four different methods of operation may be selected. The control can be locked for the desired method, thereby preventing tampering with the safety features.

The safest method of operation is obtained by setting the control for using the push-but-



Oilgear "Cyclematic" Broaching Machine in which the Broaches are Automatically Released and Re-engaged

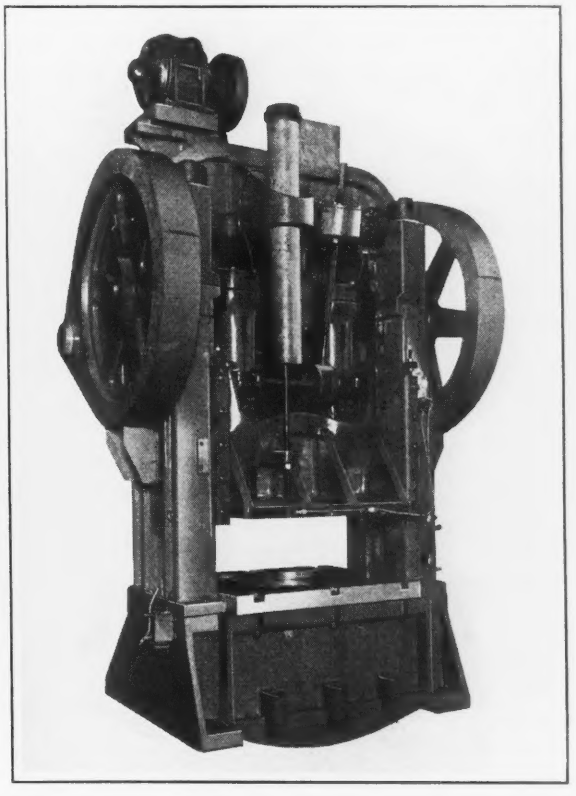


Fig. 1. Niagara Crank Press with Electrical Control that Provides Four Different Methods of Operation

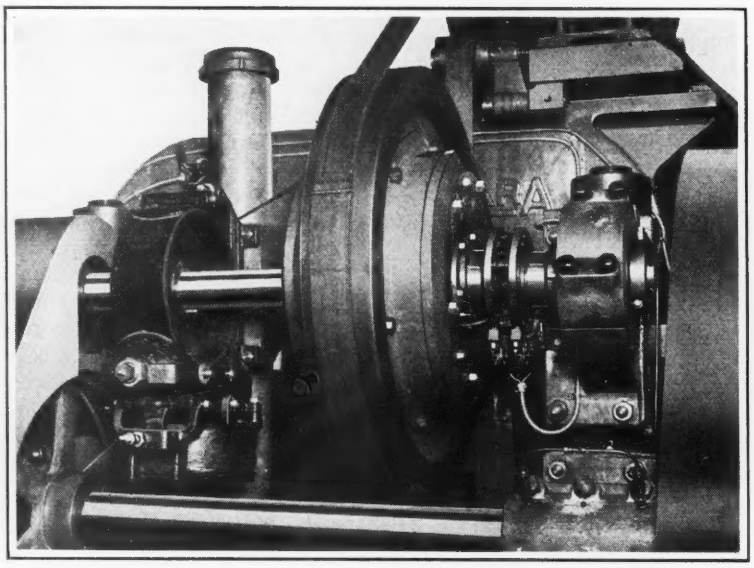


Fig. 2. View of the Electro-magnetic Clutch and Brake on the Niagara Press

tons on the slide. When these push-buttons are depressed, the slide will descend to the bottom of the stroke. The buttons may then be released so that the slide will return to the top of the stroke, where it stops automatically. If any of the buttons are released while the slide is on the down stroke, it stops instantly. "Inching" operation can be obtained by setting the control for using the upper button on the right-hand housing. The slide will then operate continuously as long as this button is depressed, and stop instantly at any position in the stroke when the button is released. This control is most convenient in setting dies.

When it is desired to have the slide make a complete cycle and stop at the top of the stroke, the control can be so arranged that this is accomplished by depressing and releasing the push-buttons on the slide. As long as the buttons are depressed, the slide will repeat its cycle. When continuous operation is required in connection with a roll feed mechanism, the control may be so set that the press will be started by means of the upper button on the right-hand housing and it will then continue automatically until the lower button is depressed.

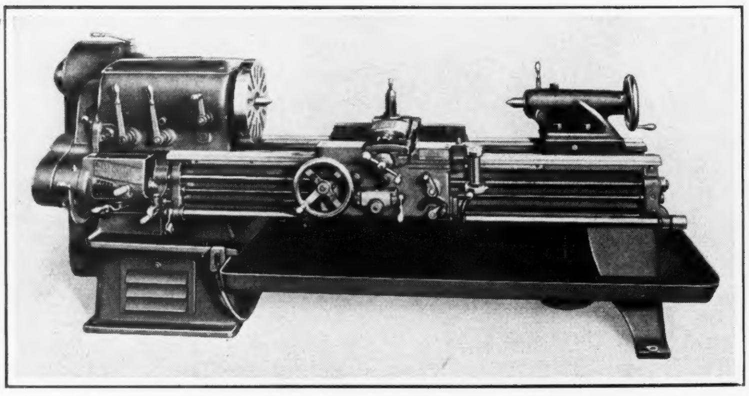
The clutch is of the multiple-disk type, and its magnetic operation is such that the friction surfaces are engaged gradually without a grabbing effect. The clutch is built into the flywheel. The electro-magnetic brake is automatically released when the clutch is engaged, and is instantly applied to stop the press when the clutch is disengaged. The brake mechanism is a separate unit, mounted apart from the clutch so that no heat from the brake is transmitted to it. The mounting of the brake and the clutch is clearly illustrated in Fig. 2.

The press has an 8-inch shaft, and is of the four-piece steel tie-rod frame construction. The slide is counterbalanced by springs enclosed in steel cylinders. There is a motor-driven adjustment for the slide. The machine is arranged for an individual belted motor drive through a self-adjusting ball-bearing idler. A central pressure lubricating system with an indicator supplies positive lubrication to all the bearings on the machine.

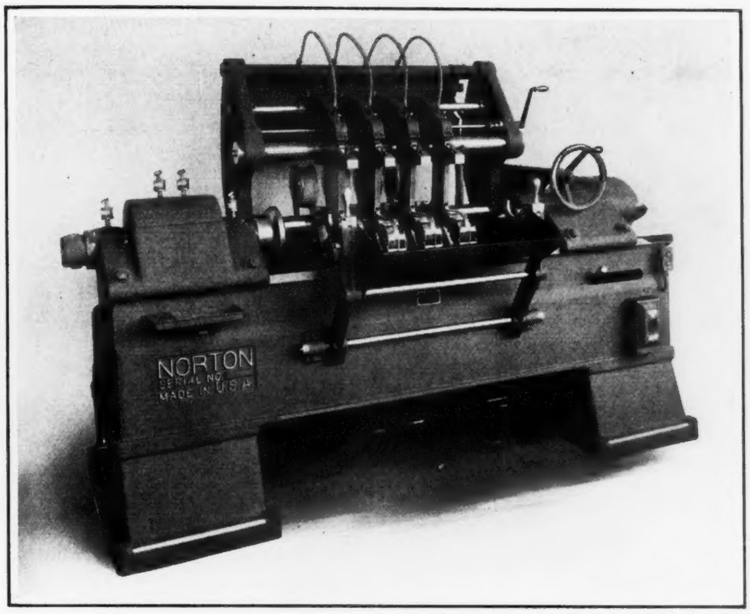
Reed-Prentice Sixteen-Speed Sliding Gear Head Lathes

A new line of lathes with sixteen-speed sliding-gear headstocks has been brought out by the Reed-Prentice Corporation, Worcester, Mass. This line includes 14-inch, 16-inch, 16-inch heavy, and 20-inch sizes. The new quick-change gear mechanism with which the lathes are equipped makes it possible to obtain all thread and feed changes without the use of pick-off gears. The end gears are mounted on anti-friction bearings.

These features are now also standard for the eight-speed 14-inch, 16-inch, 16-inch heavy, and 20-inch sliding gear head lathes manufactured by the same concern. The new line embodies the four-bearing spindle mounting, with Timken tapered roller bearings, and other features of the eight-speed lathes.



Sixteen Speeds are Available in a New Line of Reed-Prentice Sliding Gear Head Lathes



Norton Machine which Laps Simultaneously the Pins and Bearings of Automotive Crankshafts

Norton Crankshaft Lapping Machine

Improved features are embodied in a machine now being placed on the market by the Norton Co., Worcester, Mass., for lapping simultaneously the pins and bearings of automotive crankshafts. The crankshaft to be lapped is rotated between a live headstock center and a floating footstock center. The lapping is accomplished by abrasive paper carried in rolls by telescoping reels on the lapping arms. Each time that a lapping arm is removed from a pin or bearing, the reels index automatically so as to present a fresh abrasive surface to the next pin or bearing to be lapped.

A reciprocation mechanism in the headstock moves the crankshaft back and forth in the direction of its axis. This materially improves the finish and eliminates all grinding-wheel marks. Lapping lubricant is delivered to each arm by a pump which, with its driving motor, is a complete unit.

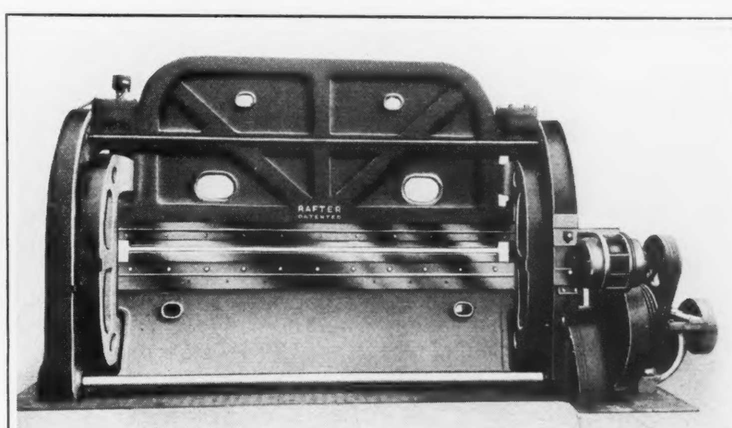
The headstock is fixed at one end of the bed, while the footstock is adjustable to accommodate a range of crankshaft lengths. The footstock center is operated by a treadle, permitting the operator to use both hands for loading and unloading. A work-loading fixture can be attached to the front of the bed to facilitate handling heavy crankshafts.

The supporting housing for the lapping arms is a special feature of the machine. When the lapping of a crankshaft has been completed and each lapping arm is released, the supporting housing can be swung backward by turning a handwheel, which moves the lapping arms and their supporting members out of the way for reloading. The machine swings work 16 inches in diameter over the table, and will accommodate a maximum crankshaft length of 48 inches. Crankshaft pins and bearings up to 2 1/2 inches in diameter by 4 1/2 inches in length can be lapped. The weight of the machine is 4800 pounds.

Rafter Low-Drive Press Brake

The Farrel-Birmingham Co., Inc., Ansonia, Conn., now manufactures a new type of press brake, as sole licensee under patents belonging to the Rafter Machine Co., Belleville, N. J. The important feature of this machine is that the power is applied to the ram from below, so that the ram is pulled downward into the work. All the drive is attached to or contained within the base. This construction gives a comparatively low over-all height.

Motion is transmitted to the ram by two C-shaped connecting-rods, actuated by eccentrics within the base. These connecting-rods are long enough to almost eliminate the angle between them and the ram, so that they exert practically a straight down pull. The eccentric shafts are separate units, each one being amply supported in three large bearings. The ram adjusting screws are hung in the ram; in other words, they are secured rigidly only at the top. The screws are constantly vertical, so



Rafter Press Brake with All the Driving Mechanism Either in the Base or Attached to it

that the working strains are always taken in tension and the screws are not subjected to bending. The trunnion nuts have unusually long bearings, and regardless of the amount of die opening, the same number of threads engage the screw.

The uprights carry none of the operating mechanism, with the exception of the motor, and are therefore not subjected to any working strain, the motor driving the flywheel through multiple V-belts. The single function of the uprights is to keep the ram in alignment with the base. The base is of A-shape, and is designed for maximum strength and rigidity, so as to resist deflection and prevent weaving.

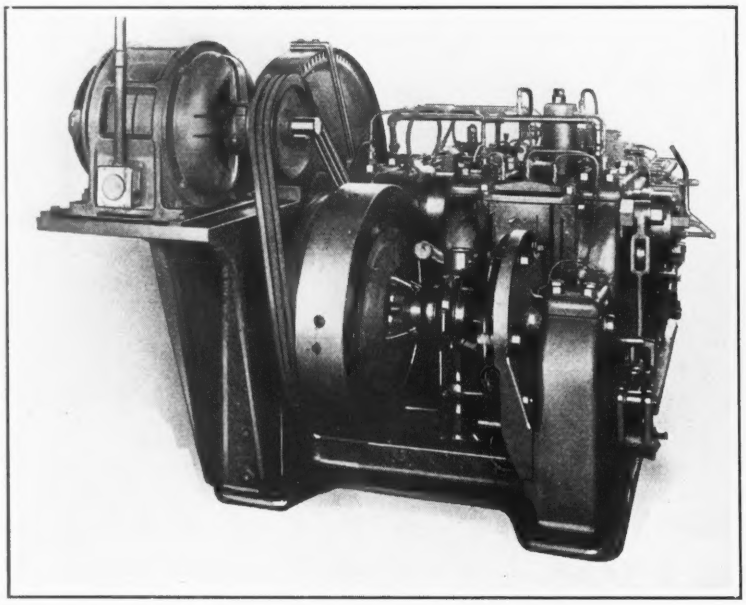
The design of this press brake permits using dies the full length of the ram and base. The construction consists of heavy rolled-steel plates, welded together. The drive shaft and the flywheel are equipped with roller bearings. The friction clutch is electrically controlled by push-buttons operated by hand or foot. The die-holder is designed to release the die quickly in case the brake is jammed. By simply loosening a few bolts, the two clamping members that hold the die are separated so that the die is permitted to drop, and the work can then be removed without danger to it, to the die, or to the machine. Brakes in several sizes up to 300 tons capacity will be carried in stock. Larger sizes will be built to order.

Oliver Double-Arbor Motor-Driven Saw

The two circular saws of a double-arbor wood-working saw, recently designed by the Oliver Machinery Co., Grand Rapids, Mich., are driven by individual motors. These motors are built in directly on each of the two ball-bearing arbors. The arbors and their motors are supported by a one-piece casting, which is revolved readily by means of a handwheel to bring either saw into the upper or cutting position. Sixteen-inch diameter rip and cross-cut saws are furnished regularly, but larger saws can be supplied for use one at a time, and a dado head may also be used.

Acme Friction-Drive Forging Machines

Forging machines built by the Acme Machinery Co., Cleveland, Ohio, are now provided with a friction drive for which a number of important advantages are claimed. Instantaneous starting of these machines is obtained by merely applying a slight pressure to the foot-treadle. In this way, production increases of from 15 to 20 per cent are said to be possible, and because there is practically no loss of heat from the stock being worked, better forgings can be produced. The heading tool has a positive movement without play or backlash, a feature which permits the metal being worked to flow uniformly. It also eliminates the tendency of the crank to recede ahead of the driving member after passing the center.



Acme Forging Machine with a Friction Drive

Silent operation is another feature of these machines. The friction drive cushions the starting and stopping action, thus eliminating shock to the machine and the motor. If the machine should be stalled, due to an overload, the clutch will cushion the stopping of the flywheel. It is mentioned that the cushioning effect lowers maintenance costs.

With this friction drive, the flywheel is the only rotating member when the machine idles. The slight pressure applied to the foot-treadle releases the energy of a spring which engages the driving clutch. The machine then moves through the heading and receding cycle. On the return stroke, the driving clutch is disengaged and a braking clutch engaged. The contour of the cam is such that the crank is always stopped at the extreme back end of the stroke. The cam also compresses the spring for the next operation.

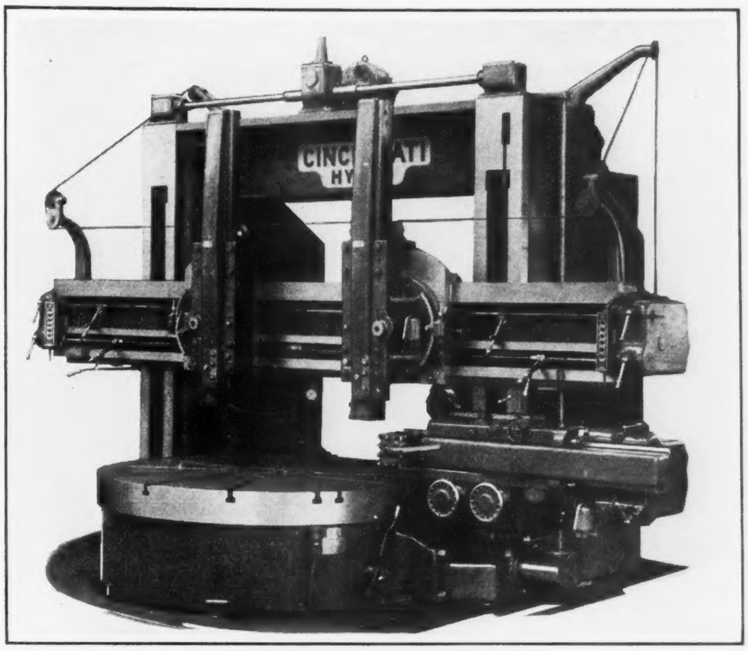
By an additional improvement in the construction of these machines, the dies are held closed with a uniform grip through the long heading and receding cycle. The fully suspended header and movable-die slides are located above the point where water and scale can attack them. Integral toggle pins back up the dies with a continuous bearing through their entire height.

A vertical relief mechanism functions automatically in case the operator allows the work to be caught between the flat faces

of the forging dies. After this relief operates, it automatically straightens out at the end of the completed stroke.

Lincoln Time-Delay Switch

A time-delay switch unaffected by temperature changes or operating conditions has been developed by the Lincoln Electric Co., Cleveland, Ohio. The operation of this switch may be likened to the well-known hour glass, since its principle is the slow movement of mercury from one chamber to another. As the mercury rises in a compartment, it completes the circuit at the various taps. By changing one connection to the different taps, a variation in time delay is secured. This type of switch can be built for an accurate time delay of from two to twenty seconds.



"Hypro" Vertical Boring Mill with Side-head, Built by the Cincinnati Planer Co.

"Hypro" Vertical Boring Mill with Side-Head

The Cincinnati Planer Co., Cincinnati, Ohio, has recently built the 96-inch "Hypro" vertical boring mill here illustrated, which is equipped with a side-head of a new design. The saddle of this side-head is so mounted on the housing that all tool pressure is absorbed by the heavy housing wall about 24 inches from the face. Tapered gibs take up the wear and maintain the alignment. The saddle is cast with the ram clamp in place so as to eliminate a large number of bolts.

For feeding and rapid-traversing of the side-head, there is a twelve-change feed-box unit mounted on the back of the side-head saddle. Two handwheels are provided for the final adjustment of the saddle and the ram. A chip protector surrounds the side-head elevating screw. There is a counterbalance for the head inside the housing.

A feed-box having twelve changes is also mounted on each end of the rail for the rail-heads. Individual motors are connected to these feed-boxes for rapidly traversing the heads in all directions. The motors are controlled by push-buttons convenient to the operator. By providing an individual motor for each head, the operator can move either head in any direction without disturbing the other.

The rail-heads are lubricated from a central station, and the rail-ways are so lubricated that the heads slide on a film of oil. The heads can be swiveled 45 degrees each side of the center. Fine-adjustment levers provide for setting the rail-heads in any position along the rail. Electrical and mechanical rail clamps can be supplied. Both designs are interlocked with the elevating motor, so that it is impossible to raise or lower the rail while it is clamped or partially clamped. Likewise, the rapid-traverse motors cannot be engaged while the feed is being used.

The bed of this machine and its various extensions are cast in a solid unit with a view to providing a stiffer support for the housings. Forced lubrication is supplied to the spindle bearings, table track, and gear-box. The thrust of the spiral-bevel pinion that drives the table is taken by an anti-friction bearing. When a direct-current variable-speed motor is used for the drive, a four-speed change-gear box is provided. In case alternating current only is available, a triple box is placed on top of the four-speed box to give twelve table speeds.

American Hydraulic Assembling Presses

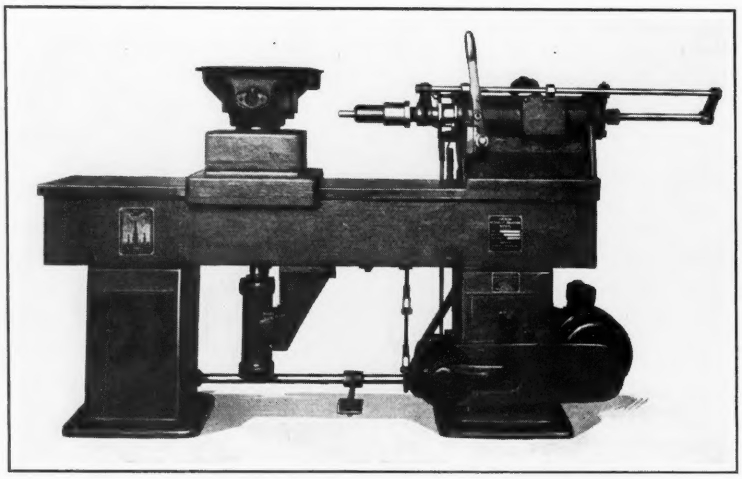
A horizontal assembly machine recently built by the American Broach & Machine Co., Ann Arbor, Mich., for assembling the brake pedal in an automotive clutch housing is shown in the accompanying illustration. This machine is equipped with a hydraulically operated fixture for holding the clutch housing. The fixture is timed in connection with the main hydraulic system that operates the ram.

After the clutch housing has been placed in the fixture, the brake pedal shaft is slipped into a nose-piece and then turned in the ram until the hole in the end is positioned by means of a plunger and spring. Upon de-

pressing the foot-pedal of the machine, the hydraulic fixture immediately locks the work in position. The ram then advances the brake pedal shaft, pushing it into the work to the proper depth. The pin-hole in the shaft registers with the pin-hole on the inside of the clutch housing. This complete cycle requires approximately eight seconds, floor-to-floor time.

The ram is operated at a speed of approximately 50 feet per minute. The hydraulic equipment consists of an American high-pressure pump, driven by an electric motor through a silent chain. The right-hand column of the machine serves as an oil reservoir. Stop dogs control the ram stroke.

A similar machine equipped with two ram heads was also manufactured recently by the same company for assembling bronze bushings in clutch housings. The bushings are fed to each of the rams by means of magazines.

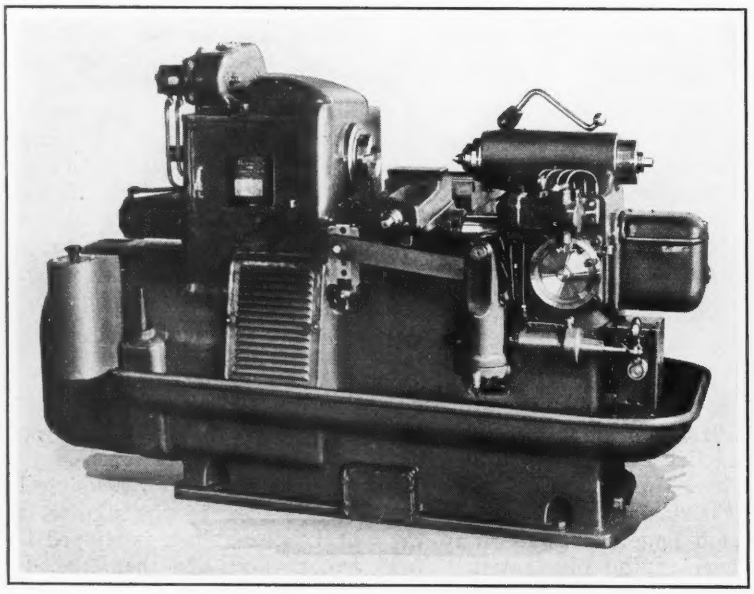


American Hydraulic Assembling Press, which has also been Built with Two Ram Heads

Barnes Automatic Lathe with Hydro-Electric Control

Automatic hydro-electric equipment on a No. 8 automatic lathe recently developed by the John S. Barnes Corporation, Rockford, Ill., controls the starting and stopping of the spindle and slides. There is no clutch. A variable-speed motor drives the machine, power being delivered direct to the spindle through multiple V-belts. The machine is equipped with the Multi-Range hydraulic feed provided on previous machines of this type.

The headstock, tailstock, bed, motor compartment, chip pan, coolant reservoir, and base are all combined in a single casting, so as to insure alignment of the various machine members. The spindle is mounted in anti-friction bearings, and can be run at the high surface speeds desired with cemented carbide tools. The spindle rotates clockwise, or opposite to the direction of spindle rotation in the conventional lathe. This feature, in conjunction with the arrangement of the front and rear carriages, places the full load on the lathe bed.



Barnes Automatic Lathe with Complete Hydro-electric Control of the Spindle and Slides

The feed-pumps are of Barnes design, and they are driven from the main spindle. A separate Barnes gear pump supplies the power for the rapid traverse of the front and rear carriages. This pump is driven by an individual motor. Both the front and rear carriages are automatically traversed to and from the work. The front carriage is first fed forward to bring the tools to the correct cutting depth, and then moved longitudinally, finally dropping back to relieve the tools on the return stroke. This arrangement also provides for turning tapers with a standard machine, as the pivot for the guide bar can be adjusted to suit straight or taper turning. Individual feed dials are provided for regulating the feeding rate of each carriage.

The tailstock center is carried in a sleeve that is quickly actu-

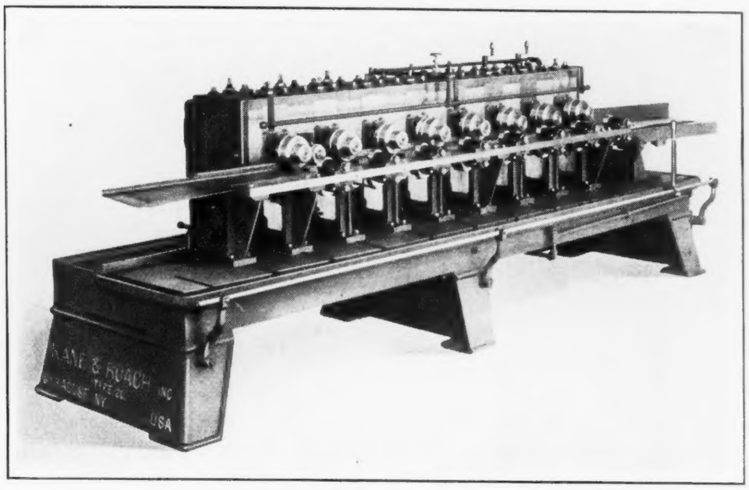


Fig. 1. Cold-roll Forming Machine Built for Hemming Ford Running Boards in Soviet Russia

ated and clamped by a single lever. The sleeve is mounted in an adjustable quill. The tail-stock center is of the live type, and is mounted in anti-friction bearings.

Kane & Roach Cold-Roll Forming Machines

A new line of cold-roll forming machines known as the Series L is being placed on the market by Kane & Roach, Inc., Syracuse, N. Y. The machines in this line are of a basic design which permits ready adaptation to specific jobs or classes of work.

For example, Fig. 1 shows a machine fitted for forming the hemmed edges of running boards for Ford Model A automobiles. This machine was supplied to the Soviet Republics through the Amtorg Trading Corporation. As it is intended for a single purpose, it requires no elaborate gearing. A silent chain drives from the motor to a clutch idling sprocket, which is mounted on an extended worm-shaft. The housings are arranged in double-stand units, each of which consists of two upper and two lower shafts, the two lower ones being driven by spur gears from an intermediate shaft that is driven by worm-gearing. The top roll shafts are driven by spur gears which mesh with those on the bottom roll shafts. The machine is equipped with roller bearings throughout.

It will be seen that the machine illustrated in Fig. 2 is of the same basic design, but it is equipped for a different class of service. In this machine, "square" gearing provides a large adjustment of the vertical center distance between the rolls. Thus shallow shapes can be formed on rolls of small diameter and deep sections on rolls of large diameter without requiring changes in the gearing or other parts of the machine. When extremely deep shapes are formed or a section is made deep with the last few rolls only, as many of the top rolls as required can be direct-driven by means of large-diameter gears.

The buyer of this machine stipulated that no spur gears were to be overhung and that the primary drive should be from a lineshaft through bevel-gear reductions. These changes were possible by altering the existing patterns slightly and making several new ones.

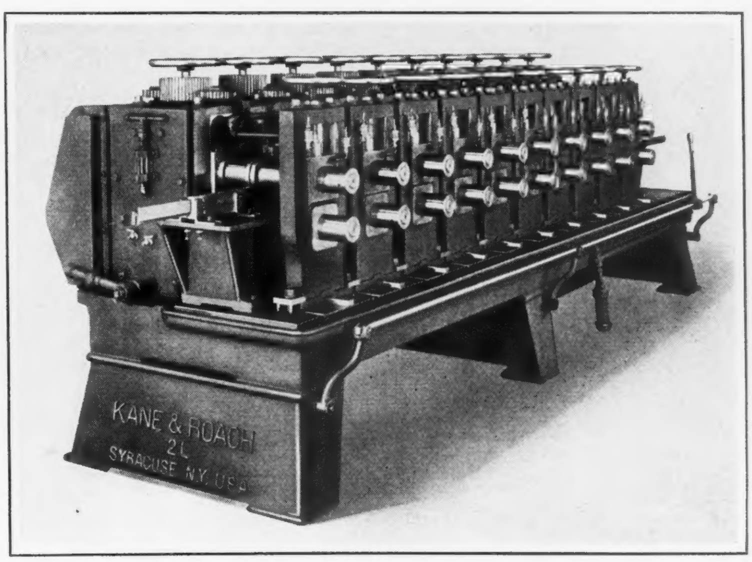


Fig. 2. Forming Machine of the Same Basic Design as that in Fig. 1, but Equipped for a Variety of Work

Grob Continuous Filing Machine

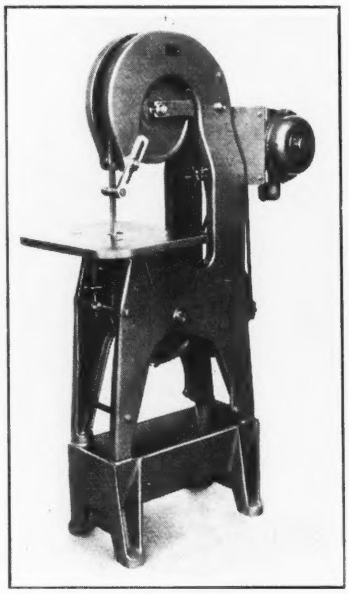
A floor-type continuous-band filing machine, just placed on the market by Grob Bros., 90th and National Aves., West Allis, Wis., embodies features that are claimed to give speed and accuracy in filing and lapping punches, dies, and miscellaneous parts. The two sheaves over which the file-chain operates, as well as the reduction drive pulley, are mounted on ball bearings.

Positive driving of the chain is obtained through a series of pins in the lower sheave that match the links of the chain. These drive pins are cushioned by helical springs so that they can adjust themselves properly to the chain links. This insures

a positive drive without stretching or otherwise harming the chain.

Proper tension is maintained in the file-chain through a handwheel on the right-hand side of the machine which actuates the upper sheave through a hinged bracket. This handwheel is also cushioned by a spring, and an adjustable pin close to the spring acts as a stop as soon as the spring is properly compressed. The arrangement prevents overtightening of the chain.

The replaceable back support over which the files slide is hardened and ground. The files are guided firmly against the ground surface by means of a rubber roller. This machine is driven through V-belts by a 1/2-horsepower motor.



Grob Filing Machine Mounted on Chip Base

Logan Hydraulic Power Unit

A hydraulic power unit suitable for operating chucks, work-holding fixtures, clamps, hoists, etc., is being placed on the market by the Logansport Machine Co., Logansport, Ind. This unit is of the accumulator constant-delivery variable-pressure type. It has a pressure range of from 50 to 200 pounds per square inch, the pressure being adjustable through a regulating valve.

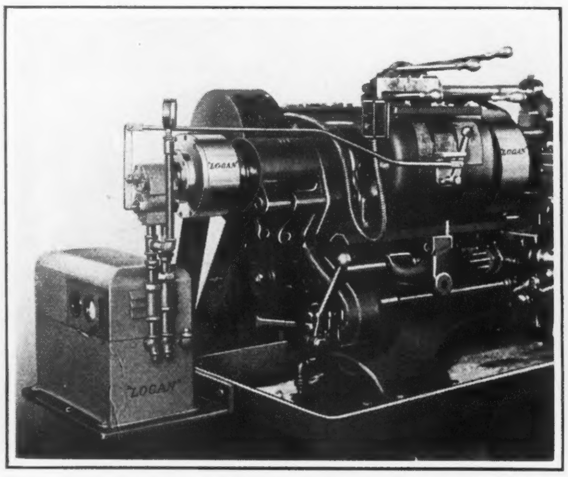
The illustration shows this power unit mounted on a turret lathe for operating a Logan three-jaw universal chuck. An 8-inch Model HV cylinder is also employed. The hydraulic control valve is integral with the cylinder. The operating time of this hydraulic equipment is 1 1/2 seconds. A constant pressure is applied on the work by means of this equipment.

The accumulator is of the spring type, and acts as a pressure reserve for the hydraulic unit. The accumulator pressure ranges from 225 to 275 pounds per square inch and is always above the maximum pressure taken out through the regulating valve. When a pressure of 275 pounds per square inch has been built up in the accumulator, the motor is cut out automatically, and when the pressure has dropped to 225 pounds per square inch, the motor is automatically started to build the pressure up again to 275 pounds. With this method of pressure control, there is no by-passing of oil.

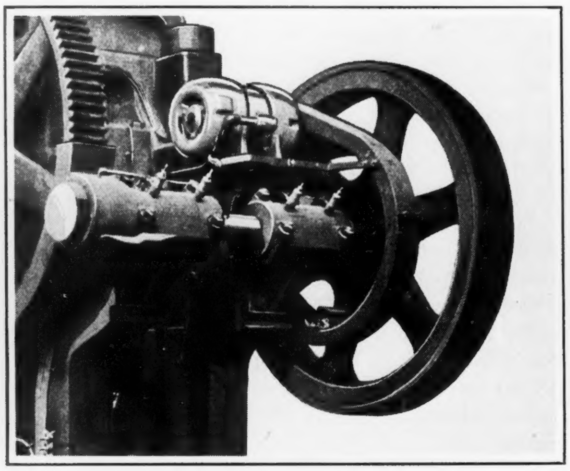
Reliance Punch-Press Motors

Induction motors especially adapted for driving punch presses and other machinery with similar operating characteristics have been developed by the Reliance Electric & Engineering Co., 1088 Ivanhoe Road, Cleveland, Ohio. These motors range in size from 3/4 to 200 horsepower. During the unproductive part of the operating cycle of a press, the motors deliver power to the flywheel. When the work is being done, they slip and permit the flywheel to carry the brunt of the load. The motors develop a starting torque of approximately 225 per cent, and have a slip of from 8 to 12 per cent. Normal starting current is required.

Among the advantages claimed for these motors are lower installation and operating costs and an improved power factor that enables a smaller motor to be used, with resultant power savings. The motor frames are



Logan Hydraulic Power Unit Applied to a Turret Lathe for Operating a Chuck



Installation of a Reliance Motor Designed Specifically for Punch-press Service

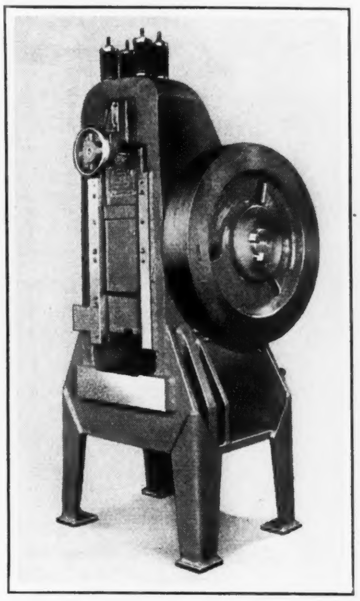


Fig. 1. Henry & Wright Welded All-steel Knuckle-joint Press of 200 Tons Capacity

fabricated from bar steel, electrically welded. Large conduit outlets make connections easy. The motors are furnished with either ball or sleeve bearings, and can be obtained in fully enclosed open or fan-cooled construction.

Z-Metal

The Rockford - Northwestern Malleable Corporation, Rockford, Ill., has produced a new ferrous metal which is claimed to combine the simplicity and adaptability of a casting with the strength and reliability of a forging. The physical properties of Z-Metal, as it is termed, can be accurately varied to meet the special requirements of each application.

Castings of this metal have a smooth outside surface. Only a small amount of stock need be allowed for finishing, and the castings are easily machined. Another feature of this metal is that sections can be cast as light as 1/8 inch. Hardness in excess of 500 Brinell is obtainable.

Henry & Wright Welded Steel Presses

Extensive additions have been made to the line of welded all-steel presses built by the Henry & Wright Mfg. Co., Hartford, Conn., since the inclinable and single-crank, straight-sided types described in May MACHINERY, page 708, were brought out. These additions include double-crank straight-sided presses, horning type presses, straight-sided knuckle-joint presses, and double-crank overhanging gap-frame presses, as well as special machines. Practically all the single-crank, double-crank, and knuckle-joint presses are of the shrunk-in tie-rod type, although some presses have been built with solid frames when special tooling and other conditions warranted that construction.

In either type of construction, the frame members, slide, and large gears are arc-welded steel units. These units are annealed and normalized before any machining is performed, in order to release stresses set up in the rolling or welding processes.

The 200-ton capacity knuckle-joint press illustrated in Fig. 1 is one of a battery made in the solid frame type in order to keep the right-to-left over-all dimension at a minimum for the required die space. The design of the slide and link mechanism is such that a guide-way length approximately 50 per cent greater than is customary on a press of the same capacity is obtained without increasing the over-all height. The machine has a 1/2-inch stroke and operates at 65 strokes per minute. Slide adjustment is obtained by means of a wedge. Continuous force-feed lubrication is supplied to the hardened and ground pins and link linings from a pump and oil reservoir located at the rear. Finished parts facilitate the mounting of special feeds previously used only on cast-iron frame presses.

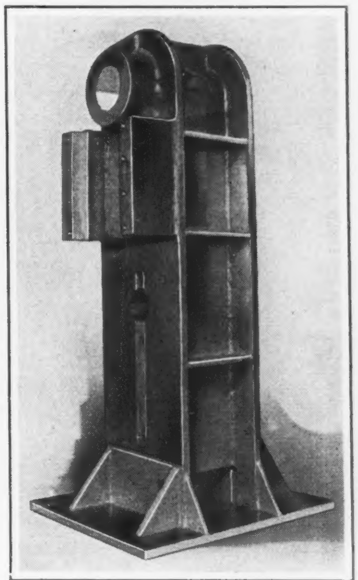


Fig. 2. Arc-welded Steel Frame Built to Replace One of Cast Iron

Fig. 3 shows a fixed inclined, open-back press built to meet special tool requirements. The inclination is 15 degrees from the horizontal. This press has an unusually large bed area and opening for its capacity. Although the machine is lighter in weight than a press of corresponding crankshaft diameter having a cast-iron frame, an increase of over 30 per cent in die life has been obtained on a battery constructed in this manner.

The same concern is also prepared to furnish

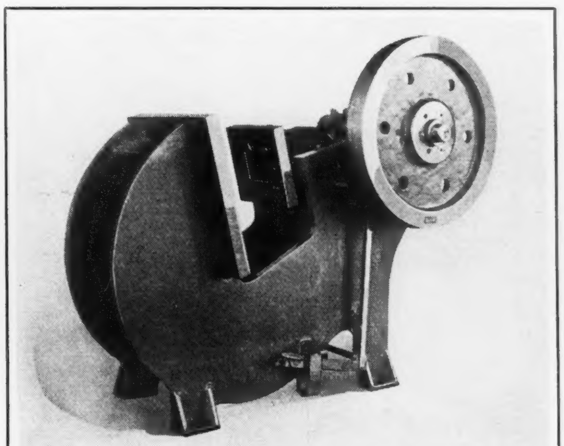


Fig. 3. Fixed Inclined, Open-back Press Designed to Meet Special Tool Requirements

welded-steel frames for all types of presses to replace broken cast-iron frames. Fig. 2 shows a steel frame made to replace the frame of a 55-ton horning press which had broken around the horn hole.

V & O Thread-Rolling and Trimming Machine

The No. 202 1/2 automatic thread-rolling and trimming machine recently added to the line of the V & O Press Co., Hudson, N. Y., will automatically handle metallic shells up to 6 inches in diameter by 6 inches long. Parts somewhat larger can be accommodated by hand-feeding. The trimming attachment has a capacity for cutting mild steel 1/16 inch thick and other metals in proportion.

The entire machine is driven from a single power source, the two clutch shafts and the rocker arm being driven through the same train of gears. The rocker arm is pivoted on trunnions instead of directly on the driving shaft, so that the driving shaft is relieved from the operating pressure and its resultant torsional strains. The rocker arm is actuated by an adjustable toggle motion, which insures smooth threads of uniform depth and permits a variation in the number of revolutions during which the work is held under pressure. This increases the range of work that may be handled.

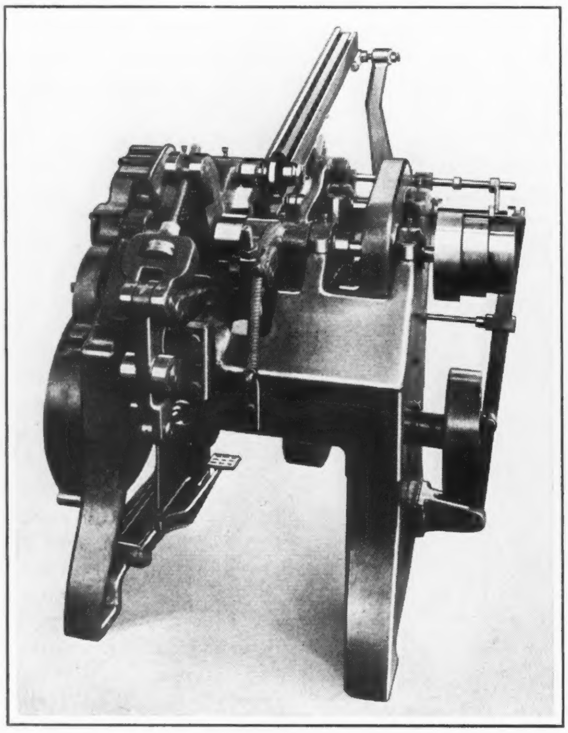
The rocker arm is brought into action by depressing a quick-acting foot-treadle connected with the clutch. If the treadle is held down, the rocker arm will run continuously. The spindles extend beyond the front of the bed, giving the operator access to the chucks when necessary for feeding by hand. The spindle that carries the upper chuck is adjustable in or out to facilitate the matching of threads.

Finished work is ejected automatically from the chucks. When trimming operations are performed, means are available for automatically separating the scrap. Beading, knurling, scoring, and flat-side rolling operations can also be performed on this machine. The tools required are quickly interchangeable.

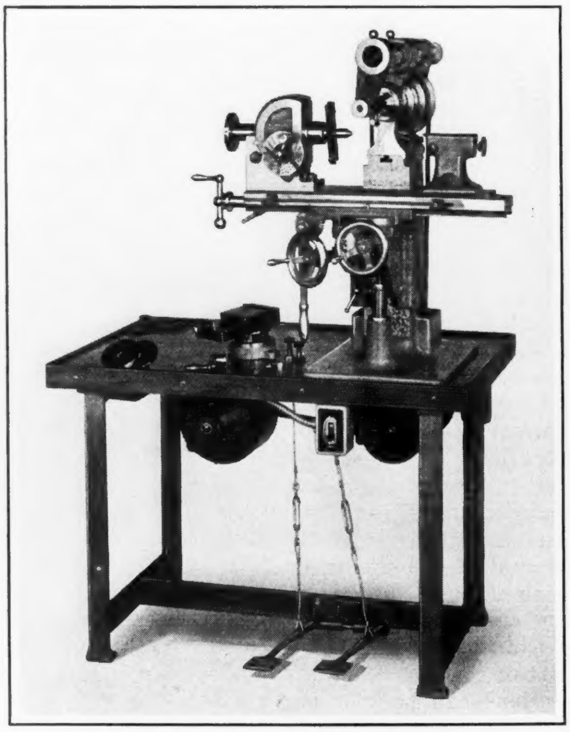
Ames Gear Drive

A two-speed reduction unit comprising gears and clutches, which is operated through a lever or foot-treadles, has been developed by the B. C. Ames Co., Waltham, Mass., for use in the individual motor drives of small milling machines, lathes, drilling machines, and miscellaneous equipment. Reverse operation of such machines is obtained by using a reversing motor and switch. The unit eliminates countershafts and jack-shafts. Shifts from one speed to the other can be made while the machine is in motion or idle.

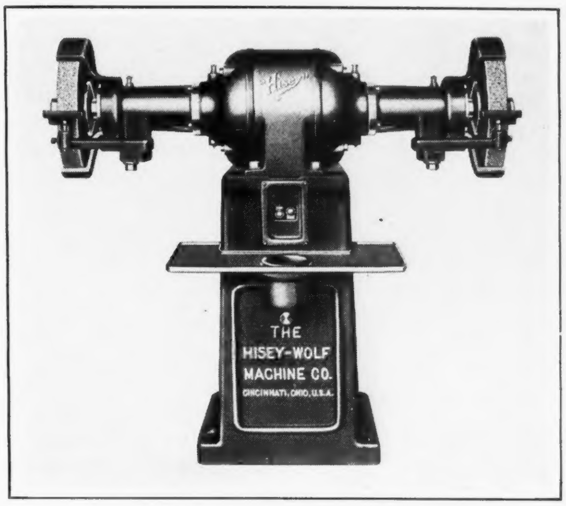
This reduction unit can be attached to the under side of a bench, as illustrated, or to the wall or ceiling. The driving and driven pulleys can be placed on either side of the unit. There is a single belt from the gear drive to the machine, and another belt or chain from the motor to the gear drive. Four stub-tooth helical gears, two of which are made of Textolite and two of steel, are in the unit. There is a multiple-disk clutch, with hardened and ground plates, for each speed.



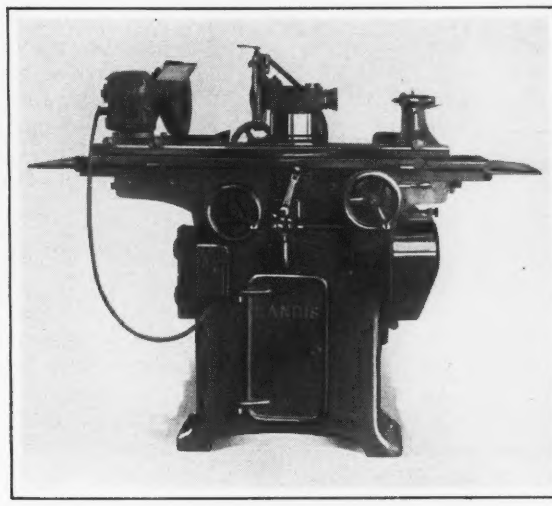
V & O Machine for Thread-rolling, Trimming, Beading, Knurling, etc.



Bench Milling Machine Equipped with Ames Two-speed Gear Drive



Hisey Wide-swing Grinders for Large and Irregular-shaped Work



Landis Tool and Cutter Grinder with Controls at Both Front and Rear

Hisey Wide-Swing Grinders

Wide-swing, floor-stand grinders of the design illustrated have been added to the line of products made by the Hisey-Wolf Machine Co., Cincinnati, Ohio. These machines are built in 2 1/2 and 3 1/2 horsepower sizes, with 12- by 2-inch and 14- by 2 1/2-inch wheels, respectively. They are built for both direct and alternating current, and are particularly adapted for grinding large and irregular shaped pieces. Ball bearings are mounted in the end caps close to the wheels. The bearings are protected from dust and grit.

Landis Tool and Cutter Grinder

On a Type B tool and cutter grinder now being introduced on the market by the Landis Tool Co., Waynesboro, Pa., certain of the controls are located at both the front and rear of the machine. With this arrangement, the operator can stand in either position and sharpen cutters with equal ease. This 12- by 32-inch machine also has a work-table guide-way construction that makes it possible to traverse the table with little effort. Moving the work-head or footstock, changing the wheels, raising or lowering the wheel-head, applying the various attachments, etc., can be easily accomplished on account of the grouping of the various controls.

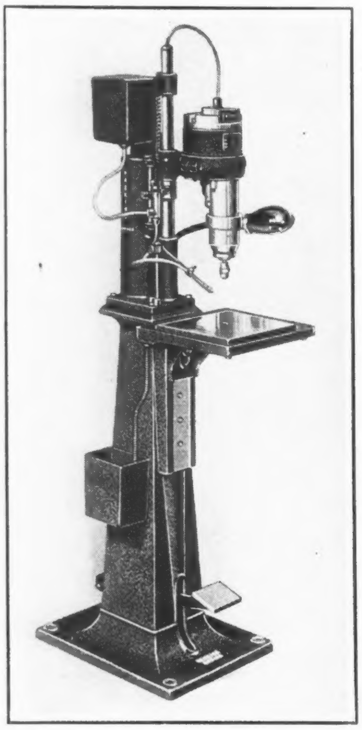
The bed of this tool and cutter grinder is of box type construction. A water reservoir is cast integral with it, so that a wet grinding attachment can be easily applied. The traverse motor and the grinding wheel motor are mounted within the bed, where they are protected from dirt and moisture. A third motor is mounted on the work-head. Three separate snap switches at the left-hand end of the bed control the motors. Three traverse speeds are obtained by merely shifting a flat leather belt, and two grinding wheel speeds are available by reversing the two-step motor pulley.

The wheel-head can be swiveled 90 degrees in either direction. A grinding wheel 8 inches in diameter is standard equipment. The work-head can be swiveled in both vertical and horizontal planes. It can be used for dead-spindle or live-spindle grinding. The motor that drives the work-head is mounted on a slotted plate so that the desired tension can be maintained in the belt.

This machine is available with plain or universal equipment. Special equipment may be had for light production work or for special tool-room jobs. For example, a multi-speed work-head and suitable footstock may be supplied instead of the standard heads. Six work speeds are available with this heavier head. A constant-speed motor is used. The plain machine, without electric equipment, weighs 2325 pounds, and the universal machine 2525 pounds.

Haskins High-Speed Tapping Machine

A high-speed tapping unit designed with a view to eliminating tap breakage is being introduced to the trade by the R. G. Haskins Co., 4634 W. Fulton St., Chicago, Ill. This self-contained tapping unit incorporates a sensitive reversing mechanism which operates at high speed. The tapping unit is enclosed in a two-piece aluminum housing. Together with the motor, it is mounted on the hollow vertical shaft of an upright machine, as shown in the illustration. Ball bearings are provided throughout the unit, except for the chromium-plated collet shaft which operates in a lubricated hardened and lapped alloy-steel bushing. Collets are furnished for taps from No. 2 to No. 14, inclusive, the machine having a capacity for tapping up to 1/4 inch in brass and up to 3/16 inch in steel.



Haskins Tapping Machine with Self-contained Head Unit

The machine is regularly furnished with gears for any two of the following tapping speeds: 1500, 1750, 2330, and 3060 revolutions per minute. Special gears can be furnished for tapping speeds of 2130, 2675, 3500, and 4000 revolutions per minute. The reverse speed is twice that of the tapping speed.

Owing to the high tapping speed, the problem of supplying lubricant properly is an important one. A pump, adjustably mounted on the left-hand side of the machine frame, is operated automatically in conjunction with the tapping. The amount of discharge can be regulated by means of a screw, and the discharge nozzle can be quickly positioned to deliver the lubricant to the point of tapping.

The vertical shaft on which the tapping unit is mounted slides in two long bearings, lapped to insure accurate alignment and permit free action without lost motion. The arm that holds the tapping unit has both vertical and side-to-side adjustments. The tapping unit and other vertically moving parts are counterbalanced, so as to give the machine a free-floating sensitive action. A spring gives a quick return of the tapping head and quick reversal of the tap. Stops on the right-hand side of the frame limit the vertical movement of the tapping head, which is obtained through the foot-treadle. The foot-treadle is equipped with suitable mechanism so that the tap establishes its own lead without stripping the threads or breaking the tap.

Moline Improved Radiator-Loop Boring, Facing, and Tapping Machine

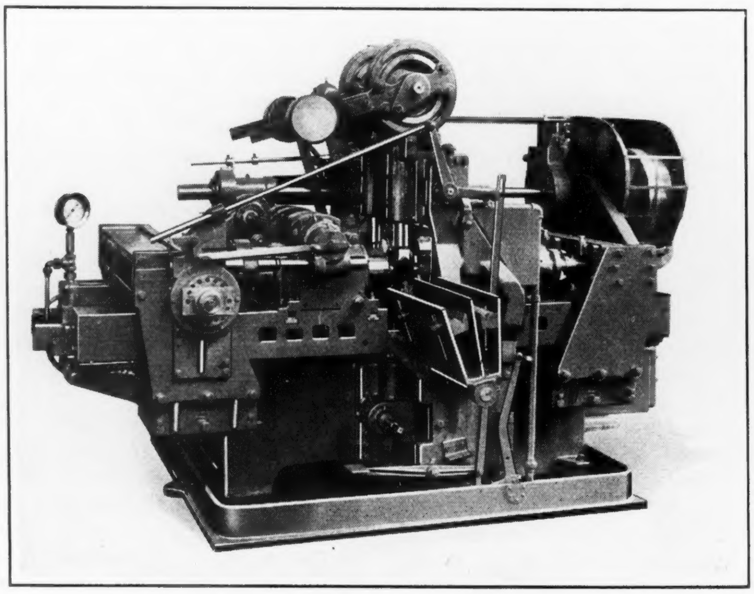
A machine recently built by the Moline Tool Co., Moline, Ill., for facing, boring, and tapping radiator loops or sections embodies a number of improvements over the previous machine produced for the same purpose, which was described in July, 1929, MACHINERY, page 868. Oilgear hydraulic equipment now provides the power for the facing operation, and there are individual lead-screws on the spindles for the tapping. The lead-screw nuts can be readily transferred from the frame of the machine to the spindles, in changing from thread-nipple to push-nipple loops.

Each facing tool and tap can be adjusted individually for depth. The control of the tapping depth, or the point of tap reversal, is entirely independent of the lead-screws. The machine reverses at a constant speed. Three different tapping and facing speeds are regularly available, through pick-off gears, to suit variations in the hardness of the work.

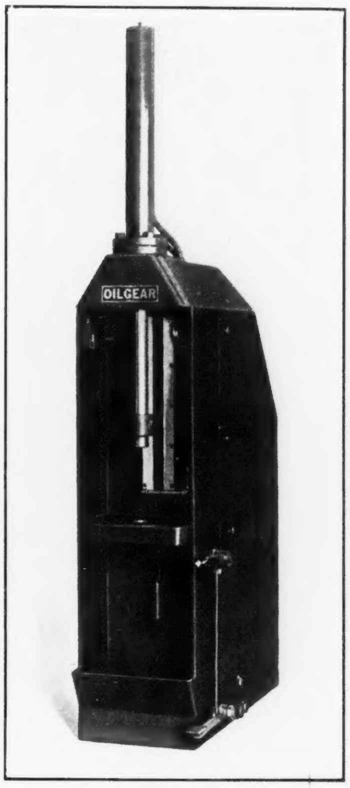
A loading device or cradle permits speedy loading and unloading. This cradle is adjustable to accommodate different widths of radiator sections. Anti-friction bearings are supplied throughout the machine. The machine is set in a heavy welded-steel pan, which has a three-point bearing on the floor to avoid possible frame distortion.

Oilgear "Allsteel" Side-Plate Vertical Presses

Presses of vertical design with a one-piece, welded-steel, side-plate frame are being placed on the market by the Oilgear Co., 1301-1417 W. Bruce St., Milwaukee, Wis., in 8-, 10-, and 12-ton capacities. These presses are



Improved Machine Built by the Moline Tool Co. for Boring, Facing and Tapping Radiator Loops



Oilgear Press with Welded All-steel Frame

intended for broaching and general manufacturing operations. They occupy a floor space of only 28 by 45 inches.

The entire operating mechanism, including the Type RSA constant-displacement pump, electric motor and drive, lubricant pump, tubing and control, is enclosed in the frame structure. Space has been allowed for making adjustments conveniently. The pump and by-pass control valve are built into one small unit. Only two copper tubes, with extruded brass fittings, are used to connect the pump and the cylinder.

The ram of these presses is guided in a long bronze liner, so as to insure positive alignment for the entire stroke. The stroke on all machines is adjustable from 6 to 27 inches. The ram speed on the 8- and 10-ton presses is 300 inches per minute in the downward direction and 600 inches per minute in the upward direction. On the 12-ton press, the speeds are 240 and 480 inches per minute, respectively.

Molded ram packing is used, which can be easily adjusted or changed.

Hand-lever and foot-pedal controls, as well as a semi-automatic control, are available. Either a Texrope or a Dayton Cog-Belt drive can be supplied. A 7 1/2-horsepower motor running at 1200 revolutions per minute is recommended. The 8-ton press weighs 2800 pounds, the 10-ton press 3000 pounds, and the 12-ton press 3200 pounds.

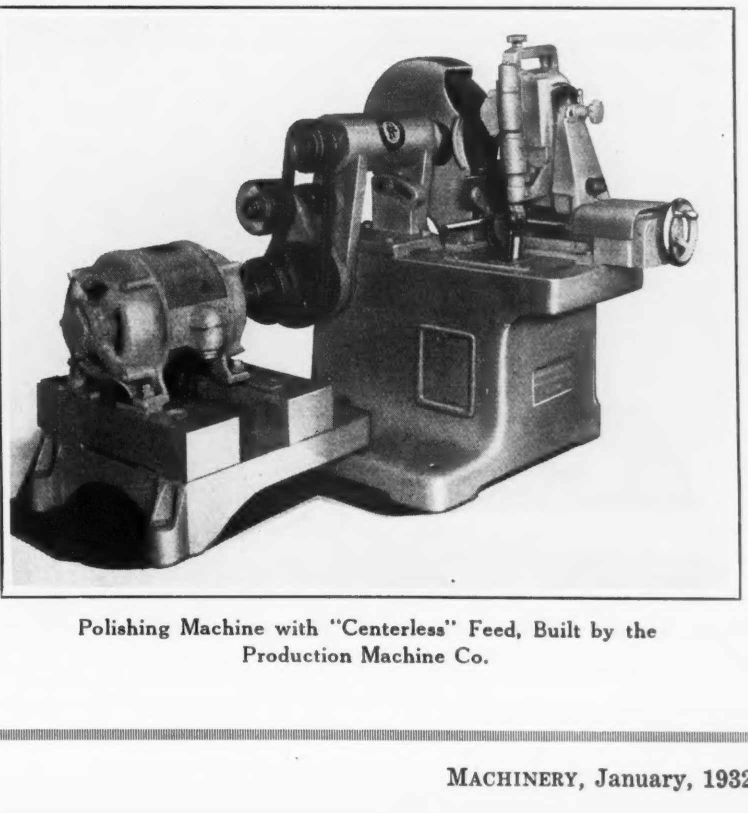
"Centerless-Feed" Polishing Machine

The Production Machine Co., Greenfield, Mass., has recently developed a "Centerless-Feed" polishing machine that employs a high-speed wheel for the polishing unit and a new patented belt device for the feeding member. This machine is designed to eliminate the need of skilled polishing labor. Adjustments are provided to accommodate polishing wheels from 10 to 16 inches in diameter with a 4-inch face width. The main shaft and wheel-spindle bearings are of the Timken tapered-roller type. The Alemite system of lubrication is provided for.

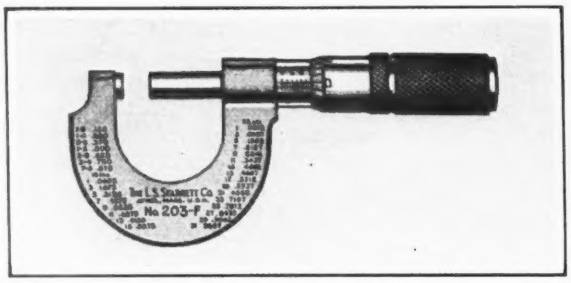
The drive from the motor to the wheel-spindle is through Dodge triple V-belts. Two wheel-spindle speeds are available. The machine is designed for quick set-up. Complete protection is afforded by hoods and guards. Cylindrical work up to 6 inches in diameter can be handled. The machine will "cut down" from the rough and produce a fine buffed finish at high rates of production. It may be driven by a motor of from 7 1/2 to 10 horsepower which is direct-connected through a flexible coupling. A motor-driven machine weighs about 1400 pounds, and a belt-driven machine about 1200 pounds.

Starrett Micrometer with Friction Stop Mechanism

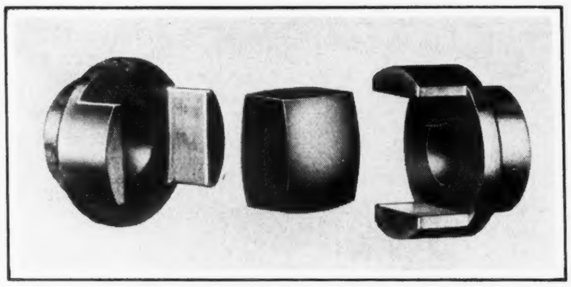
A friction stop mechanism is embodied in the thimble of a No. 203F micrometer caliper that is being introduced to the trade by the L. S. Starrett Co., Athol, Mass. With this arrangement, it is not necessary to reach beyond the thimble to operate the stop. The thimble is made in two parts, the part near the frame being connected directly to the spindle, while the other section controls the friction stop.



Polishing Machine with "Centerless" Feed, Built by the Production Machine Co.



Starrett Micrometer with Stop Mechanism in the Thimble



American Small-size Flexible Coupling with Solid Center Piece

Holding the micrometer in one hand, the operator can quickly adjust the spindle to the point of contact by means of the thimble friction mechanism. Since the stop disengages at the same pressure each time, the operator is assured of uniform contacts and all danger of springing the instrument is eliminated. If the user prefers the feel of a solid-thimble micrometer on certain jobs, he can obtain it by simply shifting his thumb and finger to the section of the thimble nearer the frame. This micrometer has a range of from 0 to 1 inch. It is available with graduations to either 0.001 or 0.0001 inch.

American Small-Size Flexible Couplings

Two smaller sizes have been added to the line of flexible shaft couplings manufactured by the American Flexible Coupling Co., Erie, Pa. These sizes have maximum bores of 3/4 and 1 inch, and have been designated No. 4 and No. 6, respectively. In general design and kinematic action, they are the same as the larger couplings manufactured by the company.

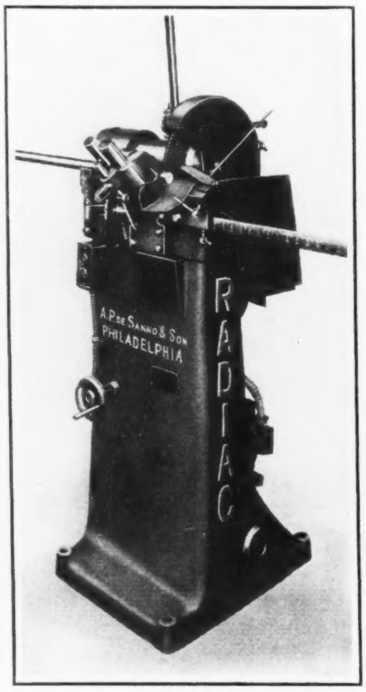
The flange sections are die-cast and have a wide groove in the face that leaves two jaws, as illustrated, between which the floating center member slides. The center member, a solid non-metallic, self-lubricating piece, transmits the torque between the flange sections.

The power capacity of the No. 4 coupling is 0.05 horsepower per 100 revolutions per minute, and that of the No. 6 coupling, 0.15 horsepower per 100 revolutions per minute. The couplings weigh 3/4 and 2 pounds, respectively. Both sizes permit a maximum parallel misalignment of 1/64 inch, as well as a maximum angular misalignment of 1 degree.

Radiac Cut-Off Machine with Automatic Features

Automatic clamping and releasing, a quick-acting work-stop, and the elimination of foot-treadle operation are features of the Radiac Type E cut-off machine recently added to the line of A. P. de Sanno & Son, 1615 McKean St., Philadelphia, Pa. The machine is operated entirely with the right hand, the work being fed by the left hand. The work is held firmly in a clamp, the action of which is adjustable to accommodate work up to 2 inches. The clamp is automatically controlled by a cam; it closes and opens when the hand-feed lever moves the cut-off disk to and from the work. Constant belt tension is maintained by mounting the motor on two arms which swing from the main shaft.

The cut-off disk measures 12 by 3/32 by 7/8 inch. The work-stop is movable along a 24-inch graduated bar. A motor of five horsepower drives the disk spindle at a speed of 5200 revolutions per minute. The weight of this machine is about 750 pounds.

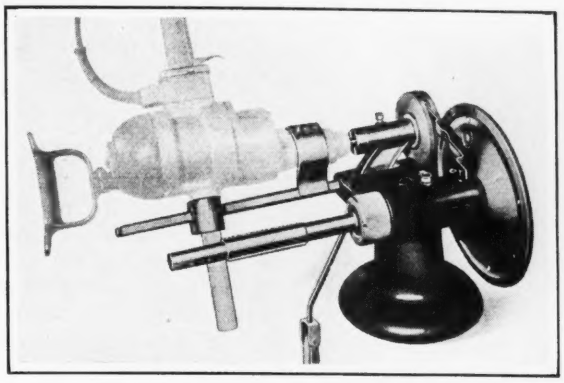


Radiac Cut-off Machine which Operates Semi-automatically

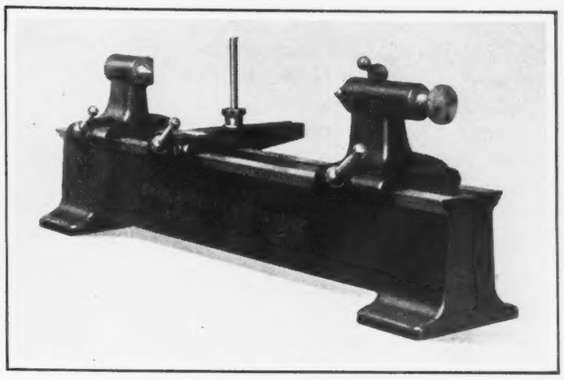
Sunnen Piston-Pin Hole Grinder

A machine that was designed primarily for grinding the piston-pin hole in automotive connecting-rods, but is applicable to a wide variety of work, is being placed on the market by the Sunnen Products Co., 7900 Manchester Ave., St. Louis, Mo. This grinder is designed to be bolted to a bench, and it can be driven by any electric drill 1/2 inch or larger in size. The illustration shows how the drill is attached to the grinder.

The mandrel in which the grinding stones are mounted can be instantly started or stopped by a foot-treadle. The speed of the mandrel is a little less than half the drill speed. With the four standard mandrels supplied, the equipment covers a range of



Sunnen Grinder for Piston-pin Holes, Driven by Portable Electric Drill



Barber-Colman Bench Center for Inspecting a Variety of Parts

holes of from 0.730 to 1.230 inches, but four extra mandrels having a range of from 1.220 to 1.620 inches are also available.

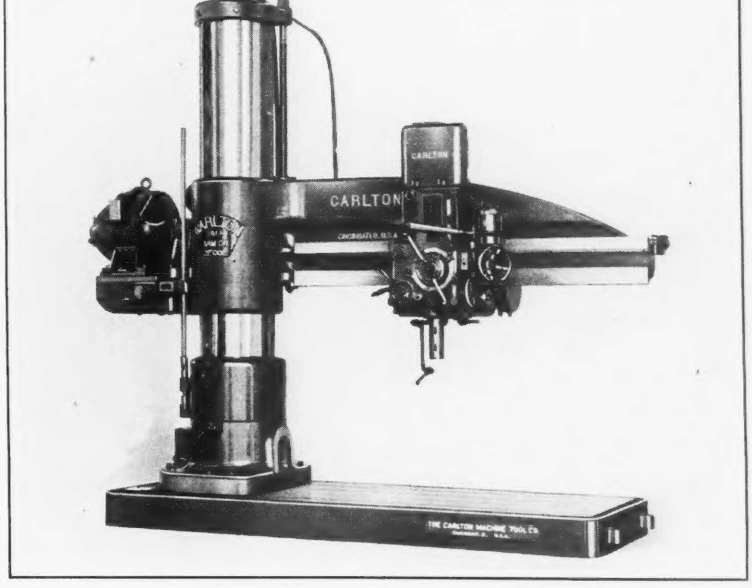
A pin fitting gage furnished with each grinder enables the operator to determine clearances positively, as the gage shows the size of the hole in relation to the piston-pin.

Carlton Radial Drill with Welded Steel Base

A radial drilling machine with a 22-inch column has been added to the line of drilling machines built by the Carlton Machine Tool Co., Cincinnati, Ohio. This machine is designed to handle the heaviest work for which radial drilling machines are adapted, taking into consideration the use of tantalum-carbide tools. A wide range of speeds is available; the smallest-diameter twist drills can be driven at their maximum speed. Seven-, eight-, nine- and ten-foot arms can be supplied.

One of the particular features of the machine is the all-welded steel base, which is claimed to have considerably greater rigidity than a cast-iron base of heavier pattern. The top of the base is made from a 3-inch plate having T-slots planed in it. A heavier plate welded to the bottom completes the box section. Ribs are welded to the plates.

The machine can be furnished with cutting lubricant equipment, an electro-hydraulic column binder, a power rapid traverse for the head, and any style of table. An adjustable-speed motor drive with a rheostat control on the head may be supplied. The drive is of the low-hung type, power being transmitted to the spindle underneath the arm at the largest spindle diameter and close to the work. In appearance and operation, this machine follows the smaller radial drilling machines built by the same company. It is equipped with ball bearings throughout. All gears are heat-treated and run in oil.



One of the Features of this Carlton Radial Drilling Machine is the Welded-steel Base

Barber-Colman Bench Center

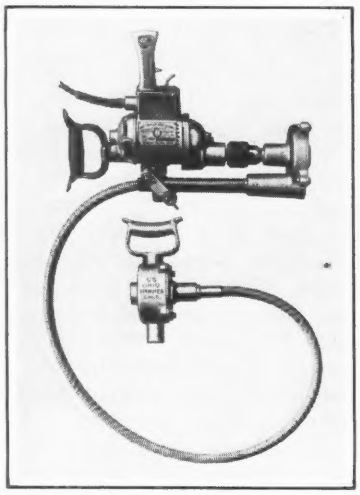
The bench center illustrated has been placed on the market by the Barber-Colman Co., Rockford, Ill. It is designed for inspecting circular, cylindrical, and other work that may be held on arbors, and such pieces as shafts, pinion-shafts, and plugs that may be held between centers. The bench center can also be used to determine the parallelism of keyways relative to the axis of a shaft, or eccentricity.

The headstock and tailstock are independently adjustable, and each is fitted with a hard-

ened and ground steel center. The slide is provided with a vertical post which can be moved to any position in or out or between the centers. This post is intended for holding a dial indicator. Other types of indicator holders can be easily attached.

Hammer Driven by Electric Drill

The accompanying illustration shows a 1/2-inch electric drill arranged for driving a hammer through the use of a flexible

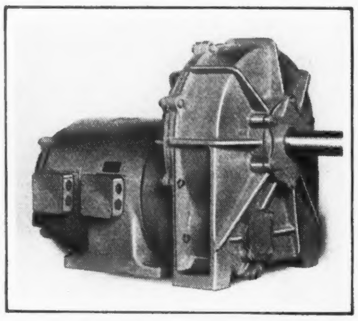


Hammer Driven by an Electric Drill through a Flexible Shaft

shaft. This hammer, which weighs only 9 pounds, is being placed on the market by the United States Electric Tool Co., 2477 W. 6th St., Cincinnati, Ohio. The flexible shaft attachment can be used with any light type 1/2-inch electric drill. In addition to making it possible to use a light weight hammer, the flexible shaft absorbs the jarring that would otherwise be imposed on the power unit. The hammer strikes 4000 blows per minute.

Sterling Slo-Speed Motors

Motors with spiral reduction gears in a compartment of one of the end-shields are being placed on the market by Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles, Calif. These motors are

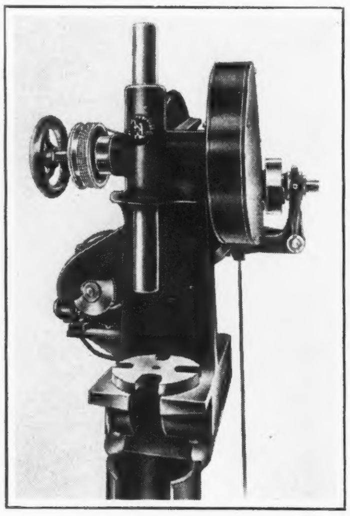


Sterling Motor with Integral Speed Reducer Unit

intended for driving machinery direct without the need of separate power transmission equipment. They are made in a wide range of sizes. Various ratios from 3 to 1 up to 30 to 1 are ordinarily available from stock, while special ratings up to 130 to 1 can be supplied to order. Motors are also manufactured by the company with the gears arranged for increasing the speed. Thus speeds from 6 to 6000 revolutions per minute are available.

Greenerd Motor-Driven Arbor Press

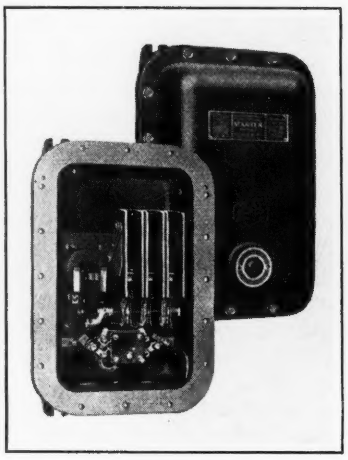
An arbor press of 3 tons capacity, with a motor drive, has just been designed by the Greenerd Arbor Press Co., Nashua, N. H. This press was developed especially for rapid continuous work,



Greenerd Motor-driven Arbor Press of 3 Tons Capacity

such as assembling, broaching, and stamping. It is also intended for die work and for use as a general utility press.

The press is equipped with anti-friction bearings throughout. A 1/2-horsepower motor, through reductions, drives the ram. The ram is hand- or foot-controlled through a friction clutch. It has a travel of 11 1/4 inches in ten seconds, the stroke being adjustable from 1/2 to 11 1/4 inches. An instant release and a fast return are provided. Work up to 12 inches in diameter can be accommodated.



Cutler-Hammer Starter with Explosion-proof Feature

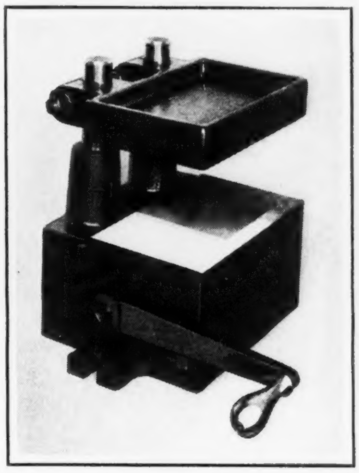
Cutler-Hammer Explosion-Proof Starter

The explosion-proof across-the-line alternating-current automatic starter here illustrated has been brought out by Cutler-Hammer, Inc., 1295 St. Paul Ave., Milwaukee, Wis. This starter has been designed in accordance with the specifications of the Underwriters' Laboratories for Class 1, Group D, hazardous locations. It is of the air break type, all contacts being made and broken in air. The heavy cast-iron enclosure is designed to prevent any explosion that might be caused within it from igniting the surrounding explosive atmosphere. These starters are made in three sizes for motors up to 30 horsepower 220 volts, and up to 50 horsepower, 440 or 550 volts.

"Sure Clamp" Jigs

A line of "Sure Clamp" jigs is being placed on the market by A. H. Pearson, 7 E. Grand Ave., Detroit, Mich., that are designed to permit any clamping pressure from 0 to 1000 pounds to be obtained instantly. These pressures are secured without any undue effort on the part of the operator.

The jigs embody a positive locking feature, as well as a 1/4-inch "follow-up," which automatically compensates for variations in the thickness of castings or forgings. Left-hand operation of the jigs is standard, leaving the operator's right hand free

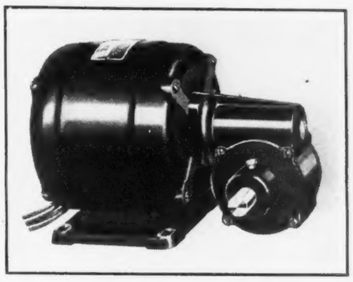


A Jig that can be Clamped at Pressures up to 1000 Pounds

for reloading and starting the feed. However, jigs can also be supplied with the operator's handle on the right-hand side if desired. Each jig has a 2-inch top-plate adjustment to accommodate parts of different lengths.

Bodine Motor with Built-in Speed Reducer

Fractional-horsepower motors with built-in worm-gear speed reducers have been brought out by the Bodine Electric Co., 2264 W. Ohio St., Chicago, Ill. Gear reductions of 10 to 1, 20 to 1, and 40 to 1 are available, affording slow-shaft speeds of 28, 43, 56, 86, 112, and 172 revolutions per minute with standard motor



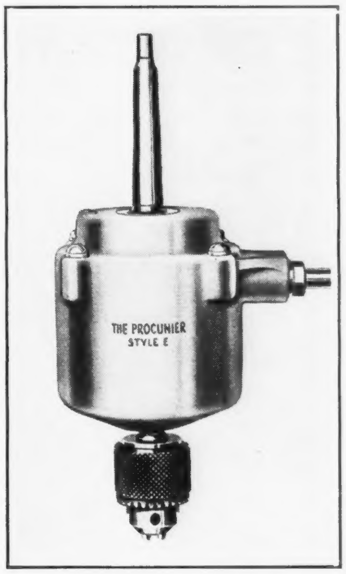
Small Motor with Built-in Speed Reducer

speeds of 1125 and 1725 revolutions per minute. The speed reducer is contained in a grease-tight housing which forms an integral part of the motor end-shield.

Double ball bearings absorb the end thrust on the rotor shaft and preserve the alignment of the gears. These motors are rated at from 1/20 to 1/8 horsepower, and are available for alternating and direct current.

Procunier High-Speed Tapping Attachment

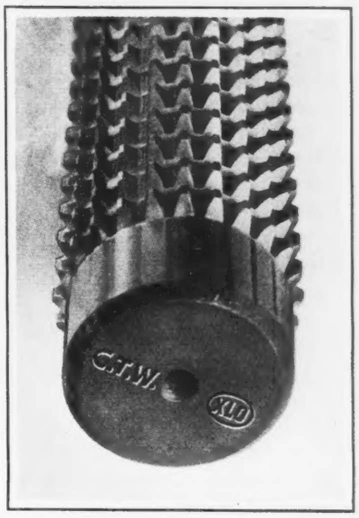
Tapping speeds up to 3000 revolutions per minute are available with the Style E "Supersensitive" tapping attachment recently brought out by the Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill. A



Tapping Attachment that Runs at Speeds up to 3000 R.P.M.

double-cone cork friction clutch drives the tap in and backs it out by engaging two driving shells which rotate in opposite directions. The clutch engagement is effected by raising and lowering the lever of the drilling machine on which the unit is installed. The tool reverses at twice the forward speed.

Jar and chatter are eliminated by the cushioning action of the cork clutch. The tap slips instantly when it strikes bottom or sticks. Ball-bearing mountings are provided. This attachment has a capacity for holes up to 3/16 inch in steel, and 1/4 inch in brass or similar metals.

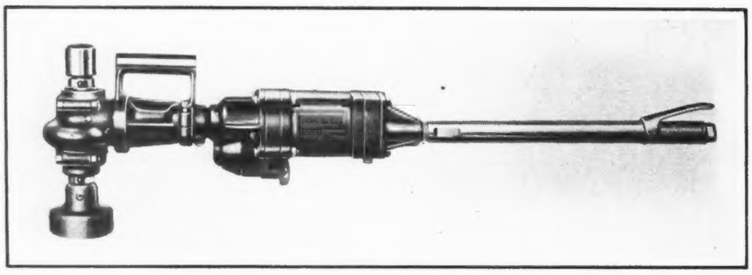


Broach that is Designed to Cut Internal Gears in One Pass

Ex-Cell-O Internal-Gear Broaches

Broaches designed to finish internal gears in one pass are now manufactured by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. The illustration shows a close-up view of the finishing end of this type of broach. The teeth are of true involute form.

These broaches start cutting from a drilled hole. The teeth must be straight in each row, so as to insure high accuracy and finish. The section of the broach at the pull end is designed to size the hole, while the remainder of the broach produces the gear



Thor Pneumatic Rotary Wrench which Runs at 160 Revolutions per Minute

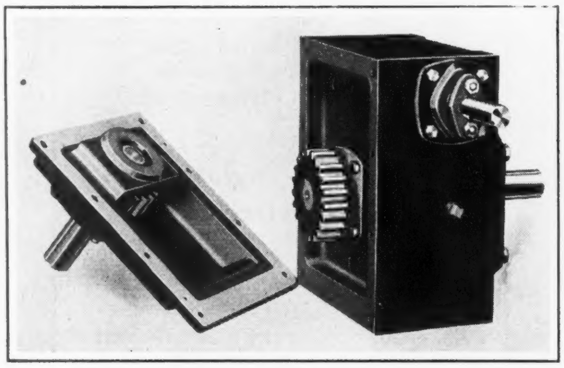
teeth. The pull end is designed for automatic coupling.

These broaches can be supplied in a range of diameters with a corresponding range in the number of teeth. They are held to limits of 0.0003 inch on the splines and to 0.0001 inch on the outside diameter. The accumulated area in the spacing of the teeth must not exceed 0.0002 inch.

Ohio Two-Speed Reversing Unit

The Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio, has brought out a new two-speed reversing unit. When this unit is used as a substitute for a bevel-gear reversing mechanism, it permits the clutch to be placed in the most convenient location, instead of necessarily between the two ends of the shafts where, as a rule, there is little room to spare. The two speeds of the unit may be provided in various ratios.

The shafts can be located on opposite sides of the housing or on the same side, and can be made to operate in the same or in opposite directions. The unit can be arranged for driving shafts, the centers of which are several inches apart, and if suitable connections are used, the shafts may be out of line as well as off center. All the gears of the unit are constantly in mesh. Being completely enclosed, the unit is dust- and moisture-proof. The ball bearings are grease-lubricated.



Two-speed Reversing Unit Made by the Ohio Gear Co.

Thor Rotary Pneumatic Wrench

A Thor No. 288 pneumatic wrench of the rotary type has been designed by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. It is intended for use in railroad shops, boiler shops, bridge and tank works, shipyards, and machine shops. It will remove 1 1/8-inch cylinder-head nuts and all flexible staybolt caps.

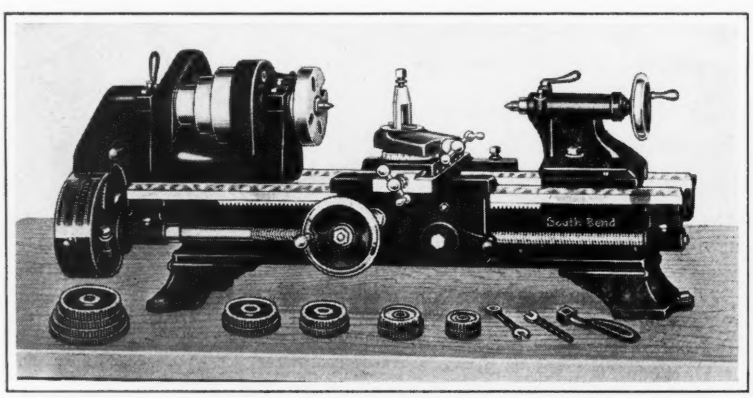
This wrench is equipped with an auxiliary handle of the swivel type for the operator's helper, which can be employed when the wrench is to be used in close quarters. When the space is unlimited, this spade handle may be replaced by a right-angle head having a lug that provides for an extension dead handle in line with the throttle handle.

The wrench is non-reversible, has a speed of 160 revolutions per minute, and weighs 48 pounds. The over-all length is 41 1/2 inches.

South Bend Eight-Inch Bench Lathe

A back-geared screw-cutting precision lathe of 8-inch swing has just been placed on the market by the South Bend Lathe Works, 730 E. Madison St., South Bend, Ind., for general-purpose use in small shops and laboratories. The back-geared headstock of this machine provides six spindle speeds. A 3/4-inch lead-screw with eight Acme threads per inch provides for cutting screw threads accurately from 4 to 40 per inch. The tailstock is of the set-over type to permit taper turning. It is equipped with a hardened and ground self-ejecting center.

This machine is available with bed lengths of 24, 30, 36, and 42 inches. All types of standard operations can be performed, and

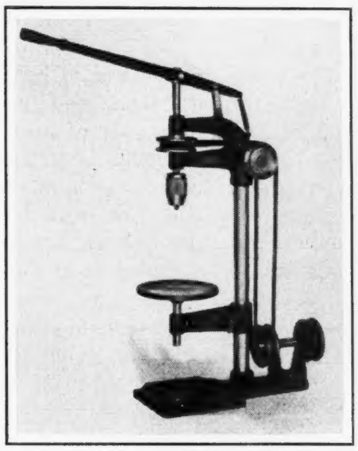


South Bend Bench Lathe for Small Shops and Laboratories

attachments are available for special work. The machine can be direct-driven by a 1/4-horsepower motor connected to an electric lamp socket.

Knipson Bench Drilling Machine

A Knipson light-duty drilling machine of the bench type, recently placed on the market by Ogden R. Adams, 266 State St., Rochester, N. Y., is shown in the accompanying illustration. This machine is equipped with a chuck having a capacity for drills up to 5/16 inch. Although the machine is shown equipped with a countershaft drive, it can be direct-driven by means of from 1/6- to 1/4-horsepower motors. The machine drills to the center of an 8-inch circle. The greatest

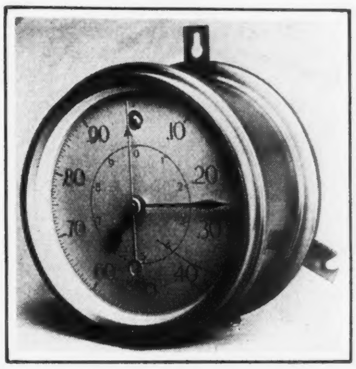


Knipson Light-duty Drilling Machine

distance from the table to the chuck is 7 inches, and from the base to the chuck, 10 inches. The weight of the machine is 15 pounds.

Telechron Industrial Timer

An industrial timer intended for use in connection with piece-rate production has been devised by the Warren Telechron Co., Ashland, Mass. The timer is turned on and off by a relay in the circuit to the motor that



Telechron Timer for Use in Timing Machine Operations

drives the machine being timed. Thus, if the motor is not running or is running under a light load, the timer will not operate. When the machine is operating, however, the increased load on the motor causes the relay to turn on the timer, thus automatically recording the actual working time of the machine.

The dial of this device differs from the usual clock dial in that the long hand indicates one-hundredths of an hour instead of minutes, and the short hand revolves once every ten hours instead of every twelve. When the timer is in operation, the dial is illuminated.

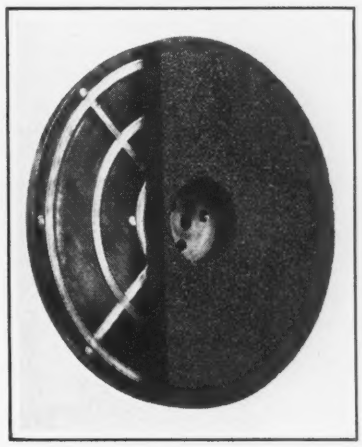
Cleveland Worm-Gear Reduction Unit

A recent addition to the series of standard worm-gear reduction units manufactured by the Cleveland Worm & Gear Co.,

Cleveland Worm-Gear Speed Reducer which Transmits up to 7 1/2 Horsepower

3276 E. 80th St., Cleveland, Ohio, is designed to transmit up to 7 1/2 horsepower, the capacity depending upon the reduction ratio and the speed of the worm. Nine standard ratios of this Size 70 unit, varying from 4 5/6 to 1 up to 60 to 1, can be shipped from stock. An additional list of fifteen special ratios is available.

The unit can be supplied in both horizontal and vertical types. The horizontal units are built with the worm either below or above the gear. In one vertical design, the gear-shaft extends upward, and in another, it extends downward. All shafts are mounted in anti-friction bearings. The gear-shaft mounting of the vertical types is such that the unit will withstand an external downward axial thrust of 2000 pounds.



Improved "Titan Steelbac" Abrasive Disk

Besly Improved "Steelbac" Abrasive Disks

"Titan Steelbac" abrasive disks, made by Charles H. Besly & Co., 118-124 N. Clinton St., Chicago, Ill., consist of a comparatively thin steel plate on which abrasive grain is bonded by Bakelite. The steel plate is designed to be bolted to the steel wheel of disk grinders. When these abrasive disks were first brought out, as described in February, 1929, MACHINERY, page 477, it was intended that the user return the steel plate

to the company for refilling after the abrasive had been worn away. However, this practice proved inconvenient, and the company is now placing on the market an improved line of "Steelbac" disks, one of which is shown in the accompanying illlustration. When the abrasive of these disks has been worn away, it is economical to throw away the steel back.

From the illustration it will be seen that the steel plates are slightly cupped on the outer edge to confine the abrasive, and have a series of reinforcing circular and cross beads or ridges pressed into them to increase the rigidity. These beads or ridges serve as anchorages for the abrasive.

"Steelbac" disks are made with the abrasive as one solid piece in sizes up to and including 30 inches in diameter. Disks 42, 53, and 72 inches in diameter are made in four or eight sections.

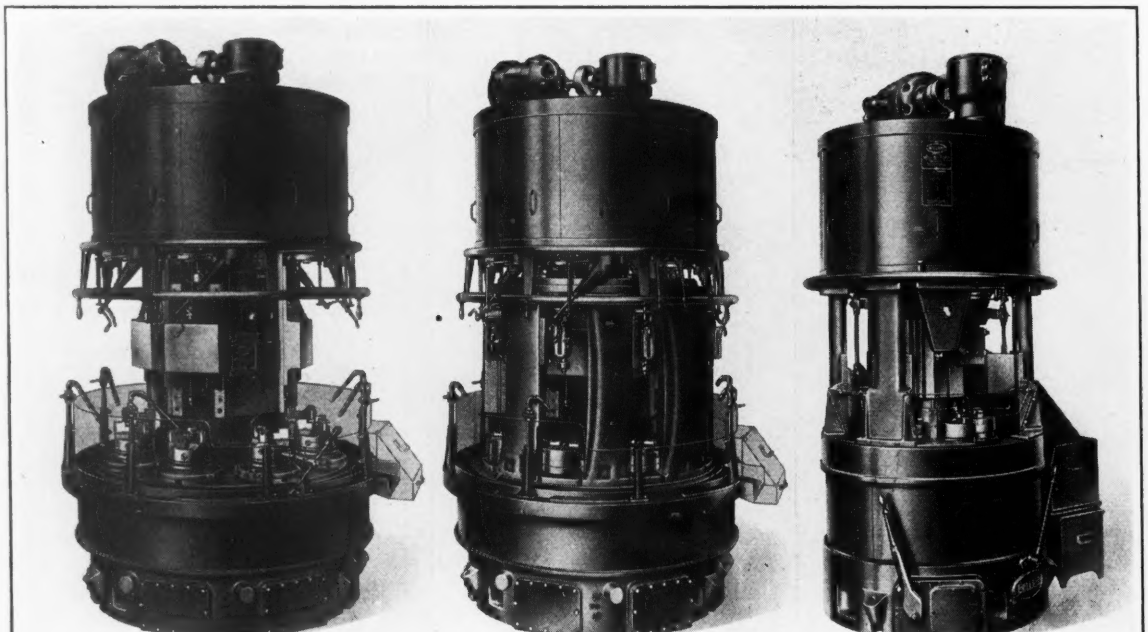
Bullard Six- and Eight-Spindle Mult-Au-Matics

An analysis made by the Bullard Co., Bridgeport, Conn., of present-day manufacturing requirements in relation to the high speeds and feeds possible with the new cutting tools led to the production of the Mult-Au-Matics here illustrated, which are built with either six or eight spindles. These machines have been designed not only with present needs in view, but also to meet future developments in cutting tools. The Type D Mult-Au-Matic is shown at the left in the illustration, the Type D Mult-Au-Matic center lathe in the center, and the Type C Mult-Au-Matic at the right.

These machines provide suitable feeds and speeds for the new cutting tools and have been designed with the necessary rigidity throughout. Automatic lubrication is a feature, as well as the extensive use of anti-friction bearings. A variety of multiple tool carrying heads and drill heads is available to meet a range of requirements.

Referring to the Type D machines, the base has been heavily designed to serve as a rigid surface plate on which to mount the machine and insure continued alignment. The column has been materially strengthened through the cross-section areas of the side walls and ribs. On the lower portion of the column is a long taper carrier bearing, while on the extreme lower end is mounted the lower race of a ball thrust bearing. The feed works of the tool-carrying heads are solidly mounted on a base which is secured to the top of the column. The new carrier design affords a heavy single-piece casting that provides a solid support for the work-spindles. This carrier is also provided with a long lubricated taper bearing corresponding to that on the column, and the upper race of a vertically adjustable ball thrust bearing. The taper bearings of the column and carrier permit close adjustment. The taper bearing takes care of the side thrusts, while the vertically adjustable ball bearing takes the vertical thrust and gives a firm support for the entire weight of the carrier. It increases the ease of indexing the carrier.

The work-spindles are of heat-treated forged steel, and are each mounted on a pair of lubricated pre-loaded roller bearings. Individual braking mechanisms are provided for the spindles. During indexing, these brakes bring all the spindles to a stop



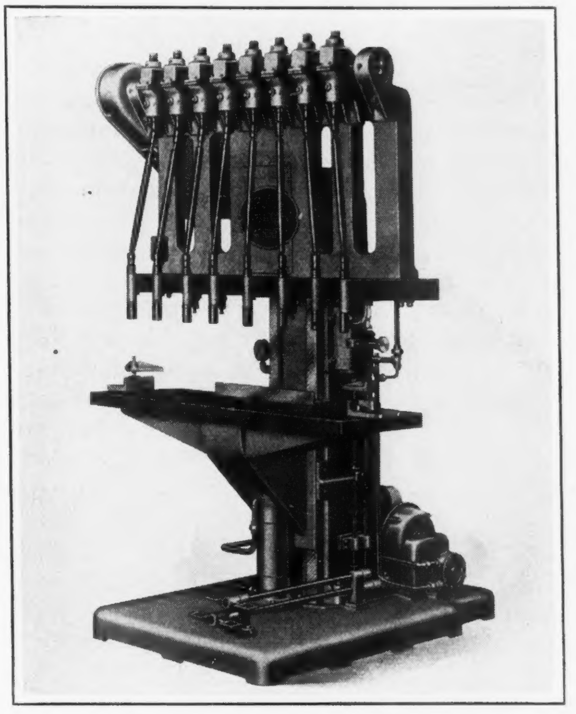
Bullard Mult-Au-Matics of New Design which are Built in Six- and Eight-spindle Styles

and thereby insure quiet and rapid re-engagement of the gears. The spindles are designed for chucks or fixtures operated manually or by mechanical power. An important feature of the feed works is the substitution of lubricated anti-friction bearings for bronze bearings throughout.

A continuously driven gear pump delivers oil from a reservoir to filters and then to the drive bracket for distribution to the feed works and the tool-heads, as well as all the other moving parts of the machine.

The Type C Mult-Au-Matic at the right in the illustration provides, for the smaller classes of work, the higher speeds desirable with the new cutting tools. At the respective work stations may be mounted various boring, drilling, reaming, facing, and turning tools. Such tools as core-drills, reamers, and boring-bars are mounted directly on the main column, which provides a uniform feed at all work stations. The tool-carrying slides are mounted on columns secured to the upper and lower sections of the machine.

A feed works unit provides the proper feeds and spindle speeds at each station through a combined system of cam and change-gears, which actuates the main turret- and tool-heads. The construction covers a wide range of operating conditions as required for small work. Through the combination of main head and tool column heads at each of the work stations, it is possible to approach the work from different directions for concentrated operations at close quarters, and still maintain sufficient room in the retired position for easy tool setting. Mechanical power-operated chucks are supplied for this machine.



Root Drilling Machine with Hydraulic Table Feed

Root Multiple-Spindle Drilling Machine

Hydraulic equipment is employed for feeding the table toward the tools on the multiple-spindle drilling machine here illustrated. This machine is a recent development of the B. M. Root Co., York, Pa., and was primarily designed for boring wood; however, the hydraulic feature adapts it for metal drilling as well.

The hydraulic equipment consists of a motor-driven rotary pump, which forces oil under pressure into a cylinder beneath the table. In the operation of this machine, if any tool should jam, a safety relief valve will operate to by-pass the oil and stop the table movement. A gage indicates the pressure on the tools at all times.

Do You Know

that X-ray inspection is now the recognized means of checking for defects in an important branch of the machine industry?—see page 353.

that steel can be hardened by rotating it in a magnetic field?—see page 327.

that silver solders are particularly suitable for use — rather than soft solders — where vibration as well as high temperatures are encountered?—see page 349.

that hair-springs in watches are now made from a nickel-steel alloy that makes the watch insensible to temperature changes and magnetic influences?—see page 337.

what cutting speeds to use for machining high-speed steel with high-speed steel tools? —see page 368.

that employes' suggestion systems can be made so successful as to yield hundreds of acceptable suggestions annually?—see page 342.

how to solve planetary gearing problems when there are two driving members rotating at different speeds?—see page 328.

what results may be obtained by welding with the shielded arc process?—see page 369.

that motorized speed reducers are now available for almost any service where a speed reducer would be used?—see page 351.

Duralumin Tanks with Riveted Joints—Comment

By F. V. HARTMAN
Aluminum Company of America, New Kensington, Pa.

The writer would like to comment on several statements made in the article "Points on Making Duralumin Tanks with Riveted Joints," published in October MACHINERY, page 135.

In the first paragraph, the author says: "Duralumin sheets used in the fabrication of tanks are generally heat-treated to increase their tensile strength." Duralumin sheets used in aircraft work are *always* heat-treated—not only to improve their mechanical properties, but also to increase their resistance to corrosion.

In the second paragraph it is stated that . . . "experience has shown that welded fuel tanks of duralumin and aluminum frequently suffer from corrosion at or near the welds." This statement is incorrect as far as aluminum is concerned. Welded aluminum tanks made from commercially pure aluminum are widely used in aircraft, and experience indicates that they are satisfactory. In a few instances, they have corroded, but the cause has always been traced to faulty welding procedure, especially improper cleaning of the flux from the weld.

The third paragraph states: "The rivets should be made of the same material as the sheets to be joined, and, as a rule, should be obtained in the annealed condition. In this condition they are generally sufficiently ductile to withstand heading satisfactorily." The same statement holds true here as in the comment on the first paragraph. Duralumin rivets for aircraft work should *never* be pointed in the annealed condition, but should always be heat-treated in order to obtain the highest mechanical properties and greatest resistance to corrosion.

In order to insure that the rivets are in the heat-treated condition, it is generally recommended that the rivets be purchased in this condition. When annealed rivets are available in a fabricating plant, there is always a chance that these rivets will be used by mistake. Such an error is not discovered until the rivets actually corrode in service. When heat-treated rivets are obtained, this cannot occur.

The heat-treated rivets are, of course, too hard to drive satisfactorily, but these can be readily reheat-treated and pointed before they have fully age-hardened. Pointing is generally done, therefore, within the first half hour after heat-treatment, but it is possible to retard age-hardening for at least twenty-four hours by quenching the rivets immediately after heat-treatment in ice water and keeping the rivets at a temperature of 32 degrees F. or less.

Again, in the third paragraph, it is said: "Occasionally, splitting or cracking of the heads of the larger sizes of duralumin rivets is observed, and in such cases the rivets should be heat-treated and quenched immediately before use." There is some question as to just what the author means by this statement. It is likely that he intends to refer to rivets that have aged for too long a time after the heat-treating procedure. Such rivets, especially in the larger sizes, are too hard to drive satisfactorily, and an attempt to drive them may result in splitting or cracking the heads. In such cases, the rivets should be reheat-treated, and, of course, driven immediately after quenching or before they have age-hardened to such an extent that pointing cannot easily be done.

The last sentence of the third paragraph reads: "If used before they have had time to age, they will harden in position." This statement seems to imply that it is not essential to drive duralumin rivets before they have had time to age. As a matter of fact, it is recommended that duralumin rivets be driven immediately after heat-treating and before they have had time to age appreciably.

At the end of the fifth paragraph, this statement appears: "For duralumin in the hard or medium hard temper, the ratio of shearing strength to tearing strength can be taken as 0.7 to 0.8." Duralumin is not furnished in such tempers. As far as we know, all duralumin that is used for tanks is supplied only in the heat-treated temper. With reference to the ratio of shearing strength to tearing strength, there is some question regarding the meaning of the expression "tearing strength." If the author means tensile strength by this term, the ratio should be approximately 0.6; if, on the other hand, he means the resistance of the sheet against the rivet tearing out through the edge, this will depend somewhat upon the edge distance employed, though largely upon the bearing strength of the material. The ratio of shearing strength to bearing strength for aluminum is about 0.4 to 0.5.

* * *

The Cleveland Conference on Metals and Alloys

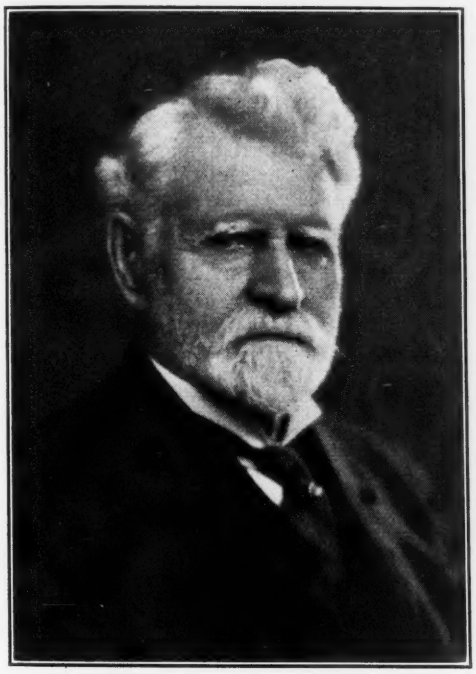
A conference on metals and alloys, sponsored by the Cleveland Engineering Society and the Case School of Applied Science, was held in the latter part of November at the Case School in Cleveland, Ohio. A three-day program was provided, including numerous papers on many phases of metallurgy. Among the subjects dealt with were: The metallurgy of alloying; stainless steels; monel metal and nickel alloys; brass, bronze, and copper alloys; magnesium alloys; nitrided steels; zinc and its alloys; aluminum and its alloys; use of metals at high temperatures; architectural metals; alloys for machine tools; bearing metals; alloys for aircraft engines; and light alloys for aircraft. In connection with the meeting, an exhibit of metals and alloys was also held.

* * *

A man is too old to hire when he refuses to learn. Some are too old to hire at twenty-five.

Ambrose Swasey Celebrates Eighty-Fifth Birthday

Ambrose Swasey, one of the founders of the Warner & Swasey Co., Cleveland, Ohio, celebrated his eighty-fifth birthday on December 19. Mr. Swasey is one of the outstanding figures in American engineering. He is a past president and an honorary member of the American Society of Mechanical Engineers and of the Cleveland Engineering Society, and is also an honorary member of the American Society of Civil Engineers. His fame is not only national, but international. He has received distinguished honors from many governments, and from engineering and scientific institutions. In 1901 he received from the French Government the decoration of Chevalier of the Legion of Honor, and in 1921 he was made an officer of the Legion of Honor. He is an honorary member of the British Institution of Mechanical Engineers, of the British Institution of Mining Engineers, and of the Society of Civil Engineers of France. In 1914 he provided the initial fund that established the Engineering Foundation, to which fund he has since generously added.



Ambrose Swasey, Dean of Engineers and Machine Tool Builders in the United States, Who Celebrated His Eighty-fifth Birthday December 19

Mr. Swasey was born in Exeter, N. H., in 1846. When eighteen years old, he began an apprenticeship with the Exeter Machine Works. Here he met, as a fellow apprentice, Worcester R. Warner, who was destined to become his life-long friend and business associate. In 1870 both men entered the employ of the Pratt & Whitney Co., Hartford, Conn.

In 1880, Mr. Swasey left the Pratt & Whitney Co., joining with Mr. Warner in the establishment of a business under the firm name of Warner & Swasey. Foreseeing the growth of industry in the West, the business was first located in Chicago; but as, at that time, workmen of the class required for precision manufacture were not available in that city, the firm moved to Cleveland in 1881. The first shop was built on a part of the site still occupied by the present Warner & Swasey plant.

In addition to manufacturing the well-known line of Warner & Swasey machine tools, the company engaged in the building of telescopes, and some of the largest and best known telescopes in the world have been constructed in the Warner & Swasey shops. In addition, transits, meridian circles, and astronomical and other instruments were developed and built.

Mr. Swasey's friends, both here and abroad, joined in extending their felicitations on his eighty-fifth birthday.

Charles L. Allen Fifty Years with Norton Company

On December 4, a dinner was given at the Worcester Club, Worcester, Mass., in honor of Charles L. Allen, president and general manager of the Norton Co., who has just completed fifty years' service with the company. On this occasion King Gustav of Sweden, through Olof H. Lamm, Consul General for Sweden to the United States, made Mr. Allen a Knight of the First Class of the Order of Vasa, in recognition of his great contributions to the development of friendly relations between the United States and Sweden. This honor has been conferred upon very few citizens of the United States who were not of Swedish descent. Congratulatory telegrams were received from many prominent men, including President Hoover and Past-President Coolidge.

Mr. Allen became connected with the Norton business in 1881, associating himself with Frank B. Norton who made the first emery wheel by the vitrified process in 1873. In 1885 the business was incorporated under the name of the Norton Emery Wheel Co., at which time Mr. Allen became its general manager. Associated with him during that period were Milton P. Higgins, George I. Alden, John Jeppson, and W. L. Messer. Since 1919, Mr. Allen has been president as well as general manager of the company, now known as the Norton Co.

Charles L. Allen, President and General Manager of the Norton Co., Who Recently was Made a Knight of the Order of Vasa by the King of Sweden

About eighty officials of the company were present on the occasion, including the managers of the branch offices throughout the country. Mr. Allen was presented with a trophy in the form of a silver tray and inkwell.

Materials Handling Institute Formed

At a meeting held in Cleveland, December 8, attended by over seventy representatives of materials handling equipment manufacturers, an organization to be known as the Materials Handling Institute was formed. The object of the association is to promote a better understanding of mechanical handling problems in the minds of industrial executives, and to secure cooperation between manufacturers.

The following officers were chosen: President, F. E. Moore, Mathews Conveyor Co.; vice-president, J. B. Webb, J. B. Webb Co.; treasurer, H. W. Standert, Northern Engineering Works; secretary, J. A. Cronin, *Materials Handling and Distribution.*

The next meeting will be held during the week of May 2 at Philadelphia, in conjunction with the meeting of the American Foundrymen's Association.

Obituaries

George P. Stephan, president of the Hoggson & Pettis Mfg. Co., New Haven, Conn., died November 13 in New Haven. Mr. Stephan entered the employ of Samuel J. Hoggson, founder of the Hoggson & Pettis Mfg. Co., July 1, 1875, and thus had been connected with the company for over fifty-six years at the time of his death. He has acted as president of the corporation since 1918.

Howard R. Sargent, engineer of the commercial engineering division of the merchandise department of the General Electric Co. at Bridgeport, Conn., died December 8 following an attack of appendicitis. Upon graduating from the Massachusetts Institute of Technology in 1893, Mr. Sargent entered the service of the old Thomson-Houston Co. at Lynn, Mass. In 1894 he was transferred to Schenectady, which was, at that time, made the home office of the company. When the merchandise department was organized in 1922, Mr. Sargent was transferred to Bridgeport as manager of the wiring supplies engineering division. He was made engineer of the merchandise department in 1926.

Harry T. Wickes, president of Wickes Brothers, the Wickes Boiler Co., and the Allington & Curtis Mfg. Co., of Saginaw, Mich., died on November 20 at Pasadena, Calif. Mr. Wickes was born November 2, 1860, at Flint, Mich., where his father and uncle, in 1856, had established a machine shop and foundry, which were moved to Saginaw in 1860 and became known as Wickes Brothers. Mr. Harry

Harry T. Wickes

T. Wickes is considered to be largely responsible for the development of Saginaw from a lumber town to an industrial city, and was well known in industrial circles. He was a member of the first board of directors of the Chamber of Commerce of the United States. Several years ago Mr. Wickes was forced to retire from the active management of Wickes Brothers and the Wickes Boiler Co. on account of ill health, although he kept in close touch with their affairs.

Donald Fraser, director and former vice-president of the Chain Belt Co., Milwaukee, Wis., died November 20, aged seventy-eight. Mr. Fraser was first engaged in the patternmaking business in Minneapolis and Milwaukee, and in 1895, became associated with the Chain Belt Co. He was very active in the early developments of the company, contributing many important inventions to the chain business. Subsequently, he became vice-president and works manager. Upon retiring in 1917, he was made a director of the company. He was also a director of the Sivyer Steel Casting Co. and the Federal Malleable Co., of Milwaukee.

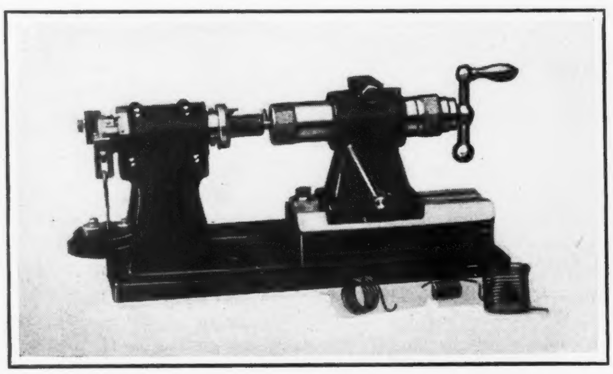
Frederick Samuel Jordan, sales manager of the nickel department of the International Nickel Co., Inc., who for the last thirty years has been an outstanding figure in the nickel industry, died at his home at 30 Fifth Ave., New York, December 16, at the age of sixty-three. Mr. Jordan was born in Berea, Ohio, and was first employed by the Big Four Railroad. Later he became private secretary to H. P. McIntosh of the Canadian Copper Co. When this company was merged with the International Nickel Co. in 1902, Mr. Jordan came to New York as sales executive, a position that he has held during the progressive development of the company.

Johannes Georg Reinecker, president of the firm of J. E. Reinecker, A. G., Chemnitz-Gablenz, Germany, died on December 8 after a short illness. His association with the firm dated from July 1, 1888. He was actively engaged in both the technical and commercial sides of the business. Mr. Reinecker was responsible for the development of Reinecker relieving lathes and large hobbing machines.

A Machine that Tests Torsion Springs

The problem of determining the strength of torsion springs mathematically is an involved one, because such springs are usually mounted on shafts, flanges, and arbors. Between these parts and the springs, or between the spring coils themselves, frictional resistances are set up that cannot be calculated accurately. Because of the difficulty of solving the problem mathematically, the Coats Machine Tool Co., Inc., New York City, recently designed the machine here illustrated for determining the strength of torsion springs mechanically. This machine was built for the Fairchild Aerial Camera Co.

The machine is constructed to permit load tests under conditions duplicating those that the springs will meet in service. The handle on the tailstock is used for twisting the spring to any desired number of degrees, as determined from a graduated dial. Weights are applied to a scale beam on the headstock.



Testing Torsion Springs in a Machine that Duplicates Service Conditions

Draftsmen Needed by Government

The United States Civil Service Commission has announced open competitive examinations for various grades of engineering draftsmen at salaries of from $1440 to $2300 a year. Applicants should apply to the United States Civil Service Commission at Washington, D. C., not later than January 12. Full information may be obtained from the United States Civil Service Commission, Washington, D. C., or from the secretary of the United States Civil Service Board of Examiners at the post office or custom house in any city. The Government also has positions open for associate and assistant ordnance engineers with salaries of from $2600 to $3200 a year. Applications must be on file by January 12.

* * *

According to the *Economic Review of the Soviet Union*, the Putilov plant produced 18,600 tractors in the first eleven months of 1931, compared with 13,100 during the entire year of 1930. The Stalingrad plant turned out 15,700 tractors, and the Kharhov works 440, making a total for the three plants of approximately 34,800 tractors during the first eleven months of 1931. The Kharhov Locomotive Works turned out twenty locomotives and the Kommunar combine harvester plant produced 434 combines during October. This is in excess of the program of the five-year plan, which called for 300 combines a month.

Get More Pieces per Cutter

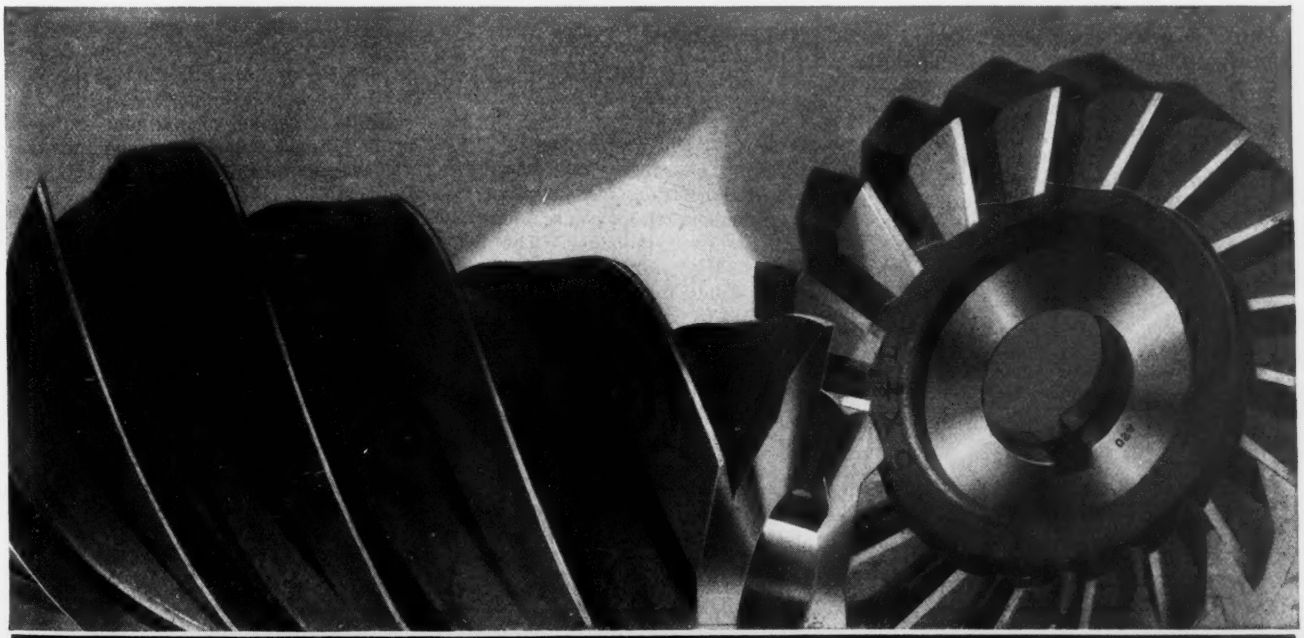
When you select cutters, you have to rely on facts to be sure of getting the best results. Cutters that give the most cuts, that require fewer sharpenings appreciably lower overhead costs, in short, they give lowest real cutter cost (see explanation at right). Incidentally they last longer, too—you buy fewer cutters.

It will pay you many times their cost to get Brown & Sharpe Cutters on every job in the shop—they give the lowest real cutter cost—the most pieces per cutter. Brown & Sharpe Mfg. Co., Providence, R. I.

The Cost of
Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase
Equals
Real Cost of Cutters

What is the *Real* Cost of Your Cutters?

B·S



Brown & Sharpe Cutters

MODERN—EFFICIENT—KEEP COSTS LOW

Personals

John J. Summersby, Jr., has been appointed assistant general sales manager in charge of resale activities of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Summersby formerly was in charge of the Holyoke Works' sales. He is a graduate of Washington University with the degree of mechanical engineer, and has been with the Worthington Corporation since his graduation in 1916.

C. F. Radley, publicity director of the Oakite Products, Inc., New York City, has been elected president of the Exhibitors' Committee Industrial and Power Shows, Inc., 420 Lexington Ave., New York City. This organization, established in 1926, is a non-profit association of manufacturers interested in the improvement of conditions relating to industrial exhibits. It maintains contacts with the managements of a wide variety of industrial exhibitions and shows.

Boyd Fisher, on December 15, assumed the duties of general manager of the National Machine Tool Builders' Association, succeeding Ernest F. DuBrul, who resigned a short time ago. Mr. Fisher is a graduate of Harvard, and has an unusually broad experience in industrial work. For many years he was engaged in industrial education activities and later in industrial management work. He was, at one time, executive manager of the Efficiency Society, and later organized the Detroit Executives' Club, which developed into an "adult education" club for 500 executives from forty factories. During the War, he was at first captain in the Ordnance Department and later attached to the office of the Secretary of War, managing industrial relations in the arsenals and organizing the education of employment and personnel managers for war contract plants, in which capacity he organized seventeen intensive training college courses. After the war he held the position of personnel director in leading industrial organizations. For the last two years he has been with the Irving Trust Co. of New York in charge of methods and procedure of the receivership division. He is the author of two books, "Industrial Loyalty" and "Mental Causes of Accidents."

Photo by Blank-Stoller, Inc.
Boyd Fisher

L. S. Horner has joined the Bullard Co., Bridgeport, Conn., in the capacity of vice-president in charge of business promotion. He comes to the company with a background of twenty-five years of manufacturing experience. During recent years he was president of the Niles-Bement-Pond Co. Mr. Horner is at present a director in that company, as well as in the Crocker-Wheeler Electric Mfg. Co., the Acme Wire Co., the Burden Iron Co., and the Trucktor Corporation.

L. S. Horner

S. Horace Disston, formerly vice-president in charge of sales of Henry Disston & Sons, Inc., Philadelphia, Pa., has been made second vice-president and assistant general manager. The sales activities of the company have been consolidated under three major divisions: David W. Jenkins will continue to direct the sales activities in the mill division; George W. Eckhardt will continue to supervise the hardware trade sales; and Harry K. Rutherford will be sales manager of the industrial division.

Ernest F. DuBrul, who, for the last ten years, has been general manager of the National Machine Tool Builders' Association, has retired to engage in private practice as consultant on finance, marketing, and management, with headquarters in the Enquirer Building, Cincinnati, Ohio. Mr. DuBrul, who is an associate member of the American Society of Mechanical Engineers and a fellow of the Institute of Management, recently won international recognition through his paper "Research in Management Problems by an American Trade Association," which was presented in July, 1931, at the meeting of the International Management Institute in Geneva, Switzerland. He is a graduate of the University of Notre Dame where he received degrees in arts, letters, and law, and has served as a director of the University of Cincinnati.

Edwin W. Rice, Jr., electrical pioneer and one of the founders of the General Electric Co., has been awarded the Edison medal of the American Institute of Electrical Engineers for "his contributions to the development of electrical systems and apparatus and his encouragement of scientific research in industry." The presentation of the medal will take place January 27 in New York. Mr. Rice entered the electrical industry when both he and the industry were young. It was in 1880, just after he had graduated from high school in Philadelphia, that he became assistant to Professor Elihu Thomson. In 1892, when the General Electric Co. was organized, he was made chief engineer and technical director; later he became vice-president, and served as president from 1913 to 1922. Mr. Rice was chiefly responsible for the establishment of the General Electric research laboratory.

Robert H. Morse, formerly vice-chairman of the board of directors of the Fairbanks, Morse & Co., Chicago, Ill., has been elected president and general manager of the company, succeeding W. S. Hovey, who resigned December 1. Mr. Morse was born in Chicago in 1878. He is the son of C. H. Morse, the founder of Fairbanks, Morse & Co. In 1895, he entered the employ of the company as an apprentice in the Beloit factory, and has been with the company continuously ever since, except for the period when he served in the Army during the War. He has held various positions, including salesman, department manager, branch house manager, sales manager, vice-president, and vice-chairman of the board.

Robert H. Morse

News of the Industry

BUCKEYE PORTABLE TOOL Co., Dayton, Ohio, has moved its factory and offices from 135 Wayne Ave. to larger quarters at 29 W. Apple St.

BUNTING BRASS & BRONZE Co., Toledo, Ohio, has opened new branch offices and warehouses at 1729 First Ave., Seattle, Wash., and 447 E. Fort St., Detroit, Mich.

HOMESTEAD VALVE MFG. Co., INC., Coraopolis, Pa., has appointed Chatard & Norris, 218 Water St., Baltimore, Md., exclusive representative of the company in the eastern part of Maryland and the District of Columbia.

FOSTER WHEELER CORPORATION, 165 Broadway, New York City, manufacturer of stationary and marine power plant equipment, has opened a branch office at 726 Jackson Place, N.W., Washington, D. C., with J. S. Malseed in charge.

FOOTE BROS. GEAR & MACHINE Co., 215 N. Curtis St., Chicago, Ill., has appointed the Neille-LaVielle Supply Co., 505 W. Main St., Louisville, Ky., local representative for the sale of the Foote Bros. line of IXL gears and speed reducers.

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich., has appointed Burton, Griffiths & Co., Ltd., Montgomery St., Sparkbrook, Birmingham, England, exclusive representatives for the company's products in England.

DARDELET THREADLOCK CORPORATION, 120 Broadway, New York City, has licensed the Automatic Screw Machine Products Co., Chicago, Ill., to manufacture nuts and screw machine products threaded with the Dardelet self-locking screw thread.

EX-CELL-O AIRCRAFT & TOOL CORPORATION, 1200 Oakman Blvd., Detroit, Mich., has appointed Fred D. Hassler, 2905 Sterick Bldg., Memphis, Tenn., manufacturer's representative, handling the complete line of Ex-Cell-O products. Mr. Hassler's territory includes Tennessee, Arkansas, Mississippi, and Louisiana.

ALLEN-BRADLEY Co., 1331 S. First St., Milwaukee, Wis., manufacturer of controllers for electric motors, has appointed the Petroleum Electric Co., 522 Commercial Bldg., Tulsa, Okla., agent in the Oklahoma territory. The Petroleum Electric Co. also has a branch office at 531 W. Main St., Oklahoma City, Okla.

DESMOND-STEPHAN MFG. Co., Urbana, Ohio, has succeeded the Simplex Corporation of Woonsocket, R. I., in the manufacture and sale of the complete line of Simplex machinists' and utility vises. This line of vises will be manufactured at Urbana in addition to the regular Desmond line of grinding-wheel dressers and cutters.

GROSS ENGINEERING CORPORATION has removed from its former location at 5730 W. 73rd St., Cleveland, Ohio, to a larger plant at 3954 W. 25th St., in the same city. The change was made necessary by the growing demand for the company's new "Leadhesion" process of acid-proof, lead-coating protection for metals subject to corrosion.

DETROIT WIRE DIE Co. has recently established a manufacturing branch in McKeesport, Pa. The new plant is located on the property of the Firth-Sterling Steel Co., for whom the Detroit Wire Die Co. makes drawing and extrusion dies with nibs of Firthalloy sintered carbide, a product of the Firth-Sterling Research Laboratories.

FUERST-FRIEDMAN Co., 1292 E. 53rd St., Cleveland, Ohio, announces that the name of the firm has been changed to the ELECTRIC GENERATOR & MOTOR Co., which is more descriptive of the business carried on—the sale, rebuilding, and repairing of electrical machinery and equipment. No change in ownership or management has taken place.

BOEING AIRPLANE Co., Seattle, Wash., has added 12,500 square feet of floor space to its plant to provide sufficient space for the manufacture of aircraft now on order. Work is under way on contracts for 210 single-seater Wasp-powered planes for the Army and Navy, in addition to seven large bombing planes. The plant is operating at capacity with 900 employes.

TIPS, INC., 515 Cathedral St., Baltimore, Md., has been incorporated for the purpose of distributing standardized cutting and welding tips, apparatus, and accessories. Otto W. Dieffenbach is president; George M. Englar, treasurer; Emory H. Niles, secretary; and L. D. Gans, assistant secretary. Mr. Dieffenbach was formerly secretary of the Black & Decker Mfg. Co., Towson, Md., and manager of the Baltimore plant.

DURIRON Co., INC., Dayton, Ohio, manufacturer of acid-resistant metals, announces the opening of a direct sales office in Buffalo at 220 Delaware Ave., under the management of Guy A. Baker, who has been transferred from the general office at Dayton. It is also announced that the Shawinigan Chemical Co., Ltd., Montreal, Canada, has been licensed by the Duriron Co. to produce Duriron and Duriron equipment for all of Canada and Newfoundland.

SHELDON, MORSE, HUTCHINS & EASTON is the name of a new service organization formed with the object of aiding industrial concerns in marketing their products. The company will have offices at 191 W. 10th St., New York City. Among other services, the company is prepared to study markets; advise on sales organizations; organize sales record systems; plan and execute advertising programs; make patent surveys; and prepare manufacturers' exhibits.

LINCOLN ELECTRIC Co., Cleveland, Ohio, manufacturer of Linc-Weld motors and Stable-Arc welders, announces that its New York office has been moved from 136 Liberty St. to the McGraw-Hill Building at 330 W. 42nd St. The new offices include a showroom and facilities for demonstrating motors, welders, new electrodes, and innovations in welding technique. G. N. Bull continues to serve as district manager in New York. Branch offices have also been established in Scranton and in Allentown, Pa., D. Levenson being in charge of the first, and F. Shackleton in charge of the second. Both men were formerly welding technicians with the Philadelphia office of the company.

WILSON-MAEULEN Co., INC., announces that the Rockwell hardness tester, made and sold by the company for the last ten years, will be handled in the future by the WILSON MECHANICAL INSTRUMENT Co., INC., 382 Concord Ave., New York City. The business will remain unchanged, except for the new corporate name. The pyrometers and controllers formerly made and sold by the company will be handled in the future by the Wilson-Maeulen Pyrometer Division of the Foxboro Co., Foxboro, Mass. All those who have been engaged in the development of the pyrometer and controller line of the company for the last fifteen years will continue in their respective capacities at the Foxboro plant.

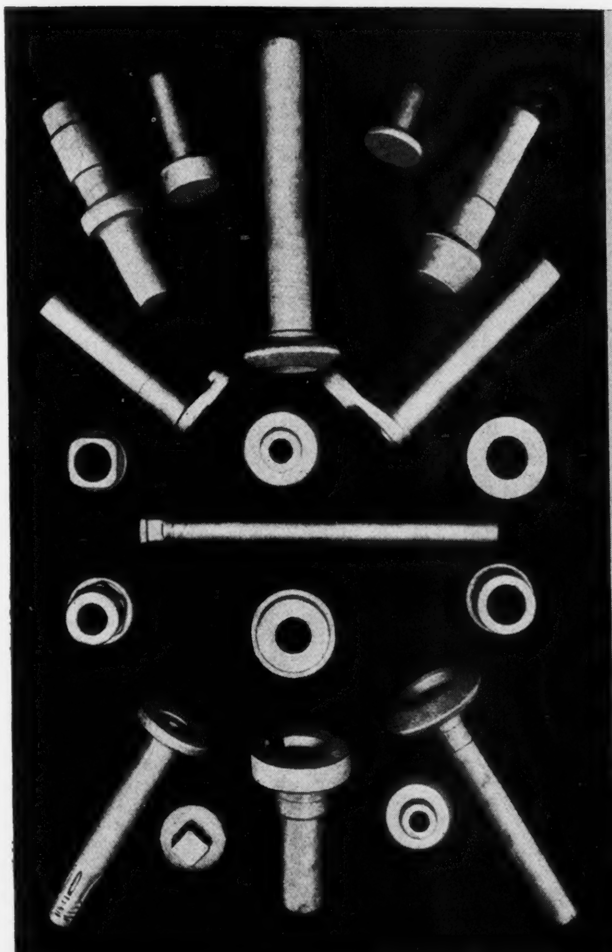
* * *

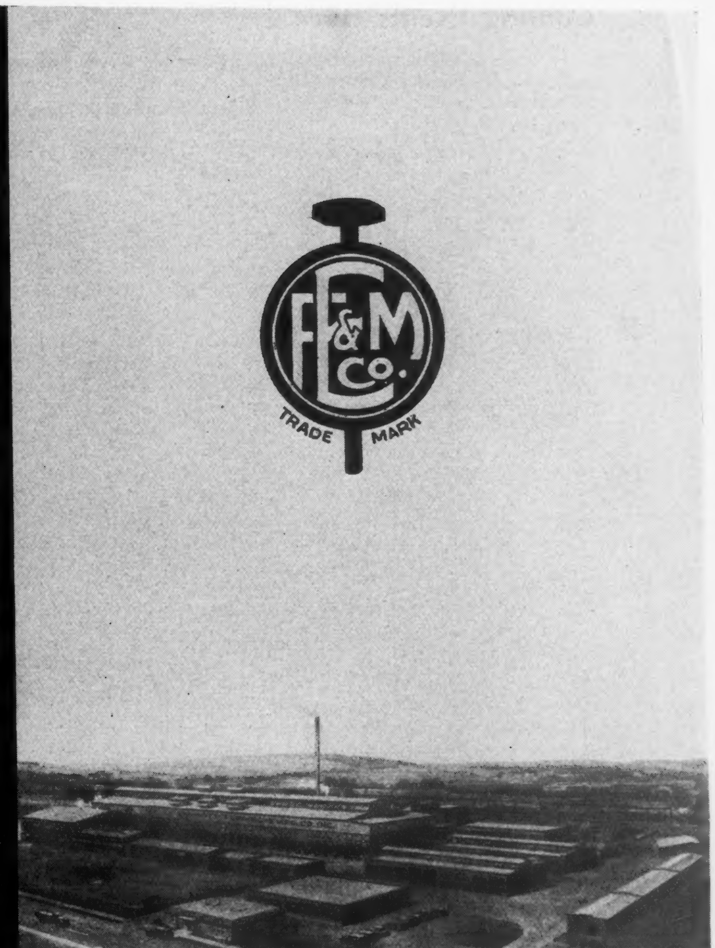
Can We Avoid Future Unemployment?

In an article in the *Executives' Service Bulletin*, Howard Cooper Johnson, vice-president of Strawbridge & Clothier, Philadelphia, Pa., calls attention to the inertia of American industry in taking definite constructive steps toward preventing serious results of unemployment in the future. Mr. Johnson writes:

"Despite the fact that unemployment is one of our most serious industrial and social problems, surprisingly little progress has been made in the United States in understanding or controlling it. The suffering of the millions who have been out of work has appealed profoundly to the sympathies of thinking people throughout the country. A magnificent attempt has been made on an unprecedented charitable scale to relieve this widespread destitution, but all this effort, splendid as it was, has done almost nothing to improve conditions and thereby prevent a recurrence. Interest in the solution of the problem aroused in periods of depression is dissipated when business improves, and the advent of the next depression finds the American public to be little, if any, better prepared.

"Our only hope of solving the problem lies in bringing the best brains in economics and in industry to a cooperative study of the subject. Economists never can solve the problem by theoretical methods alone, and it is futile to expect practical business men to be able to solve it by rule of thumb. Only in some combination of the best ideas of both is there any hope of success."





A NEW UPSET FORGE DEPARTMENT

at the

ENDICOTT FORGING
& MANUFACTURING
COMPANY
ENDICOTT, N. Y.

WHILE originally a drop forge plant producing aircraft, automotive, machinery and miscellaneous drop forgings, The Endicott Forging & Mfg. Company have in recent years become large producers of upset forgings.

They entered the upset forging field cautiously. installing first one, then a second upsetter in a corner of their hammer shop. The increasing proportions of their upset forging business led recently to the establishing of an Upset Forging Department housed in a modern building separate from the hammer shop.

The general arrangement, heating equipment and handling facilities in this department are adapted for most efficient upset forging production, and, of greater importance, the forging equipment is exclusively *AJAX Heavy Duty Upsetting Forging Machines.*

THE AJAX MANUFACTURING CO.
EUCLID BRANCH P. O., CLEVELAND, O.
Chicago Office: 621 Marquette Bldg.

AJAX

Coming Events

JANUARY 21—Annual meeting of the Steel Founders' Society of America at Chicago, Ill. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

JANUARY 25-29 — Annual meeting of the Society of Automotive Engineers at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York City.

MARCH 7-12—Packaging, Packing, and Shipping Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. Exposition headquarters, Room 602, 225 W. 34th St., New York.

MAY 2-6—Thirty-sixth annual convention and exhibit of the American Foundrymen's Association to be held in the new Municipal Convention Hall, 34th St. and Vintage Ave., Philadelphia, Pa. Executive secretary, 222 W. Adams St., Chicago, Ill.

JUNE 27-30 — Semi-annual meeting of the American Society of Mechanical Engineers, jointly with the Canadian Institute of Engineers, at Bigwin Hotel, Lake of Bays, Highlands of Ontario, Canada. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 10-17—Machine Tool Exposition of the National Machine Tool Builders' Association, at Cleveland, Ohio. Boyd Fisher, general manager, 617 Vine St., Cincinnati, Ohio.

New Books and Publications

THE RESISTANCE TO WEAR OF CARBON STEELS. By Samuel J. Rosenberg. 10 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper No. 348 of the Bureau of Standards.

BELT DRIVES WITH CAST-IRON PULLEYS AND PAPER PULLEYS. By C. A. Norman and G. N. Moffat. 20 pages, 6 by 9 inches. Published by the Ohio State University, Columbus, Ohio, as Bulletin No. 62 of the Engineering Experiment Station. Price, 25 cents.

New Catalogues and Circulars

GEARS. General Electric Co., Schenectady, N. Y. Circular 1236A, entitled "Fabroil Gears and Gear Blanks." Circular 1242A, entitled "Textolite Gears and Gear Blanks."

MOTORS. Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland, Ohio. Leaflet illustrating and describing Ohio ball-bearing slow-speed torque motors or rotating magnets.

WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Application Sheet No. 25 in a series on elements of design, discussing the design of bosses for application to welded work.

PIPE FITTINGS. Parker Appliance Co., 10320 Berea Road, Cleveland, Ohio. Bulletin 33, describing the design of Parker underground water service fittings. The circular includes price lists for the different shapes and sizes.

HONING MACHINES. Barnes Drill Co., Inc., 814 Chestnut St., Rockford, Ill. Bulletin 117, describing the features of design of the new Barnes No. 214 multiple-cylinder honing machine, with hydraulically reciprocated spindles.

HEAT-TREATING FURNACES. W. S. Rockwell Co., 50 Church St., New York City. Loose-leaf circular No. 322, containing data on the Rockwell rotary hearth furnace for heat-treating and forging ferrous and non-ferrous metals.

ELECTRIC CONTROL EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Bulletin illustrating pumps equipped with automatic control. A chart and other data showing the power saving effected by this equipment is included.

DRILLING AND TAPPING MACHINES. Textile Machine Works, Reading, Pa. Circular illustrating and describing the Reading drilling and tapping machine having a capacity for from No. 32 to 5/8-inch drills, and for from No. 6 to 3/4-inch taps.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Sheets for New Departure Application Book, containing additions and revisions to listings of types, capacities, dimensions, and mounting details of New Departure ball bearings.

INDICATING, RECORDING, AND CONTROLLING EQUIPMENT. Bristol Co., Waterbury, Conn. Catalogue 4001, illustrating and describing Bristol's "Free Vane" air-operated recorder controller for temperature and pressure control.

HEAT-TREATING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Circular outlining the distinctive features and advantages of the "Micromax," an improved potentiometer pyrometer for industrial temperature control.

MATERIAL-HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the use of the Cleveland tramrail overhead system for moving various classes of materials in machine shops.

MODELS. H. E. Boucher Mfg. Co., 150 Lafayette St., New York City. Circular illustrating the variety of models made by this concern, including models of ships, bridges, factories, office buildings, automobiles, Diesel engines, turbines, and various mechanisms.

HOBBING MACHINES. Barber-Colman Co., Rockford. Ill. Bulletin containing a detailed description of the construction of the Barber-Colman Type A hobbing machine. The last page of the pamphlet contains a drawing of the machine with over-all dimensions, and complete specifications.

GRINDING MACHINES. Churchill Machine Tool Co., Ltd., Broadheath, near Manchester, England. Pamphlet B-2, illustrating and describing in detail Churchill Model B plain grinding machines. Complete specifications are given for the two sizes—6 and 10 inches—in which these machines are built.

COUPLINGS. Dole Valve Co., 1931 Carroll Ave., Chicago, Ill. Circular announcing the Dole universal all-tube coupling, with triple compression, for use in automobiles, tractors, airplanes, refrigerators, and wherever it is necessary to connect or install a gasoline, oil, or other fluid line by means of tubing.

GEARED-HEAD MOTORS. Master Electric Co., Dayton, Ohio. Booklet outlining the advantages and features of construction of Master geared-head motors, which are designed to give speed acceleration or reduction by means of gears built into the motor. Many different applications of these motors are illustrated.

ELECTRIC EQUIPMENT. Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. Bulletin 365, descriptive of Allen-Bradley multi-speed drum controller of the reversing and non-reversing types. Circulars illustrating and describing a new line of push-button stations for heavy-duty service, and control stations for motors in water-tight and explosion-proof service.

DRILLING AND TAPPING MACHINES. Western Machine Tool Works, Holland, Mich. Circular 75, describing the construction of the Western high-speed radial drilling and tapping machine, with ball-bearing head. The circular lists twenty outstanding features that make possible economical high production, and gives complete specifications of the machine.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins GEA 821B, 1486, 1516, 1519, and 1522, illustrating and describing, respectively, pressure and vacuum switches of the diaphragm type; outdoor oil circuit-breakers; enclosed air circuit-breakers; grid-type field rheostats, and motor starting switches for small induction motors.

WELDING AND CUTTING EQUIPMENT. Bastian-Blessing Co., 240 E. Ontario St., Chicago, Ill. Catalogue 57, illustrating and describing Rego welding and cutting equipment. The catalogue lists torches, regulators, gas economizers, acetylene generators, and various accessories, and includes many helpful suggestions on selecting cutting and welding outfits.

FORM-TURNING MACHINE. Monarch Machine Tool Co., Sidney, Ohio. Catalogue describing the features of construction and the advantages of the new Monarch-Keller form-turning machine, which is designed for machining any irregular contour—triangular, square, hexagonal, or almost any shape, in addition to round or oval, for which a thin master templet can be made.

MOTORS. Century Electric Co., 1806 Pine St., St. Louis, Mo. Loose-leaf bulletin containing data on Century slip-ring induction polyphase motors for constant and adjustable varying speed. These motors are intended for installations where high starting torque is required and low starting current is desirable or where heavy inertia loads increase the time required to bring the load up to full speed.

MOTORS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Bulletin 167, covering the line of small motors made by this concern, including single-phase, polyphase, and direct-current motors in fractional-horsepower ratings. The bulletin is issued in loose-leaf form so that it may be kept up to date. Those who use, buy, sell, or repair small motors will find this bulletin of considerable value.

NICKEL ALLOY STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin entitled "Gears Made of Armor Plate," containing a reprint of an article appearing in *Metal Progress*, describing two nickel alloy steel compositions used in the rear axle and transmission gears of heavy-duty trucks and buses, as well as the fabrication and heat-treatment methods employed by one of the leading motor truck manufacturers.

INSPECTION, TESTS, AND CONSULTATION. Robert W. Hunt Co., Chicago, Ill. Leaflet containing an article on "Corrosion- and Heat-Resistant Alloys," by Clayton E. Plummer and Richard K. Akin of the staff of the Robert W. Hunt Co. Bulletin entitled "Combating Corrosion with Alloys," by the same authors. These pamphlets give the physical and mechanical properties of this class of alloys, and the types of service for which they are especially adapted.

PRECISION TOOLS AND GAGES. Taft-Peirce Mfg. Co., Woonsocket, R. I. Handbook containing 216 pages of data on gages, small tools, fixtures, special machines, and machine shop practice. This handbook also contains a detailed description of the complete line of precision tools and gages manufactured by this company, as well as the facilities the plant affords for designing and building special tools, machines, and contract work. A limited number of copies are available without charge to machine shop executives who request them, stating business connection.